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Unilateral and Bilateral Tolerances for Machined Parts and Gages[1]

by
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National Bureau of Standards

Why tolerances are needed; the applications of unilateral and bilateral tolerances, and a comparison of the merits of the two systems

Tolerance, as applied to manufactured products, may be defined as the permissible variation in a dimension of a part. This permissible variation is ordinarily expressed in terms of either bilateral or unilateral tolerances. By "bilateral" is meant permissible variation in either direction from a specified size, while by "unilateral" is meant permissible variation in one direction only.

Tolerances may be looked upon as a necessary evil. That is, if products could be manufactured to the exact size desired, and if tools and gages did not wear or change dimensions with use, there would be no necessity for tolerances. But, unfortunately, such is not the case, and the setting up of tolerances is a recognition of this.

While the basic idea of a tolerance, or permissible variation, is extremely simple, the practical application of the idea is extremely complicated. It calls for sound judgment and wide engineering experience; a nice balance of what is required of the part in question and what can be attained by the manufacturing and inspection methods available. It is equally as bad engineering to set tolerances so large, or to enforce them so inadequately, that a defective product results as it is to set them so small that their attainment can be accomplished only at prohibitive cost. In general, tolerances should be as large as proper functioning of the assembled parts will permit.

Machined products are manufactured and inspected under two general systems commonly known as interchangeable manufacture and selective assembly.

Under the first method, all parts that are nominally alike should be so nearly of the same dimensions that any part taken at random from a number of similar parts will, without further fitting or selection, assemble and function properly when mated with another part similarly taken at random from a number of similar parts with which the first part is intended to assemble.

The requirement, under this system of manufacture, is that no part in either group shall be outside of the limiting dimensions specified.

Experience has shown that unilateral tolerances lend themselves particularly well to this type of manufacturing and inspection.

A simple example will serve to illustrate the principle. Suppose that it is desired to produce a series of holes and shafts of 1 in. nominal size, that the shafts and holes can economically be produced to the same accuracy, and that no mated shaft and hole should be tighter than 0.001 in. or looser than 0.005 in. For convenience let it be agreed that the minimum hole shall be of basic size; *i.e.*, 1.000 in., and the maximum shaft 0.001 in. below basic size: *i.e.*, 0.999 in.; that the tolerance on the hole shall be 0.002 in., and the tolerance on the shaft 0.002 in. The sizes will then be specified (in inches) as follows:

			Max.	*Min.*
Hole	1.000	− 0.000		
		+ 0.002	1.002	1.000
Shaft	0.999	+ 0.000		
		− 0.002	0.999	0.997

Having decided, on the basis of experience or other considerations, that the above limits, 1.000 in. and 1.002 in. for the hole, and 0.999 in. and 0.997 in. for the shaft, are correct, it is then necessary to set up a measuring or gaging system to insure that these limits are adhered to; that is, that no hole or shaft is accepted that is outside these limits.

This could be done in a variety of ways but the accepted method in interchangeable manufacture is to provide Go and Not Go plug gages for the holes and Go and Not Go rings, or a Go ring and a Not Go snap gage for the shafts.

[1] Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

[2] Mr. Bearce, Co-Chief, Division of Weights and Measures, National Bureau of Standards, Washington, D. C., is a member of the Sectional Committee on Allowances and Tolerances for Cylindrical Parts and Limit Gages (B4). He is also secretary of the National Screw Thread Commission and of the American Gage Design Committee.

Obviously, if a correct Go plug of 1.000 in. diameter enters all holes, then no hole is less than 1.000 in. in diameter; and if a correct Go ring of 0.999 in. goes over all shafts, then no shaft is larger than 0.999 in. in diameter, and all holes and shafts that pass these correct Go gages will assemble. So far nothing is known about how loose they may be. Go gages insure only that the accepted parts will go together.

Now in order to be sure that they will not be too loose—that is, that no hole is larger than 1.002 in. and that no shaft is smaller than 0.997 in.—they must be gaged with Not Go gages; the holes with a Not Go plug of 1.002 in. diameter, and the shafts with either a Not Go ring or snap gage of 0.997 in. diameter.

If the Not Go plug does not enter any of the holes, and the Not Go ring or snap gage does not go over any of the shafts, then we are assured that no hole is too large, and no shaft is too small; that is, that all holes and all shafts are within the specified limits.

The same results may be expressed in terms of bilateral tolerances. If the same character of fit and the same limiting sizes are to be maintained as in the example given, then the set-up in terms of bilateral tolerances (indicated in inches) will be as follows:

		Max.	*Min.*
Hole	1.001 ± 0.001	1.002	1.000
Shaft	0.998 ± 0.001	0.999	0.997

In this simple case the application of bilateral tolerances is not particularly complicated. The basic sizes of the hole and the shaft are, respectively, 1.001 in. and 0.998 in., and a variation of 0.001 in. in each direction is permitted on each. The limiting sizes thus become, as before, 1.000 in. and 1.002 in. for the hole, and 0.999 in. and 0.997 in. for the shaft, and the nominal size becomes of no importance, since it is an imaginary or ideal size which is not represented by any gage and which is never measured.

At a later point in this paper it will be shown that when consideration must be given to gage size, and to tolerances and wear allowances on gages, as is always the case in interchangeable manufacture, the application of bilateral tolerances becomes complicated and confusing.

To one who thinks in terms of limiting sizes the bilateral tolerance is never used except as a means of arriving at the limiting size of each part. The problem is then recast in terms of unilateral tolerances and no further attention is paid to the nominal size or to the bilateral tolerances by means of which the limiting sizes were arrived at.

Some advocates of the bilateral system of tolerances advance the argument that on the average the ideal or desired size is more nearly maintained under this system than under the unilateral system. In answer to this it may be pointed out that in interchangeable manufacture the average size and the "ideal" size are of little or no importance. Interchangeability depends upon the size of individual parts, and so long as all parts are within the limits specified, if the limits are properly set, the parts will be satisfactory. Intelligent supervision of tools and gages will see to it that the parts are kept well away from the danger line; that is, well within the established limits. Original tool set-ups should be such that normal tool wear will result in a progressive size change in the direction of safety; that is, away from one limit and toward the other. Tools should be reset before the product size approaches dangerously close to either limit.

For example, threading dies and chasers should be so set that the resulting bolts and screws are near the low limit. Then, as the dies and chasers wear, the screw size will progressively increase, and when the maximum screw size is approached, the tools should be reset toward the low limit.

There are, of course, certain types of work, where extremely small tolerances are necessary, or where an economical manufacturing tolerance exceeds the allowable tolerance for the satisfactory functioning of mating parts, in which bilateral tolerances can be applied. In general, however, this type of work requires selective assembly. The parts are not expected to be completely interchangeable but must be individually measured and sorted into lots on the basis of size, so that large parts may be mated with large parts, and small parts with small parts.

In work of this kind the "ideal" size becomes important, and the individual parts are measured, classified, and separated on the basis of their variation above or below this size. There is no valid objection to bilateral tolerances in this type of production and inspection.

In general, then, it may be said that unilateral tolerances lend themselves best to interchangeable manufacture, and bilateral tolerances to selective assembly.

An important advantage of unilateral over bilateral tolerances in interchangeable manufacture is the ease with which tolerances can be changed under the unilateral system. Ordinarily a change of tolerance, under the unilateral system, necessitates only a change of the Not Go gage limits, whereas under the bilateral system a change of tolerance necessitates either a change of both gage limits or a change of the ideal size and one of the gage limits.

Now suppose that during the process of gaging a large number of holes and shafts the gages themselves wear. Obviously, the plugs will become smaller and the rings larger than they

were in the beginning. Let us see what effect this will have upon the inspection results.

by keeping the product within these limits.

When the questions of tolerance and wear

			Max.	*Min.*
Holes, product limits			1.002	1.000
Go plug gage	1.000	+0.0003 +0.0005	1.0005	1.0003
Not Go plug gage	1.0020	−0.0000 −0.0002	1.0020	1.0018
Shafts, product limits			0.999	0.997
Go ring gage	0.9990	−0.0003 −0.0005	0.9987	0.9985
Not Go ring or snap gage	0.9970	+0.0000 +0.0002	0.9972	0.9970

TABLE 1

Limiting dimensions (in inches) for Go and Not Go gages under the unilateral system

If the Go plug gage is allowed to wear below the low limit for the holes it will pass holes that are too small. Similarly, if the Go ring is allowed to wear above the maximum permissible size of the shaft, it will pass shafts that are too large. Then, if too large a shaft is mated with too small a hole, the clearance will be less than the minimum specified or the parts may even not assemble. On the other hand, if the Not Go gages are allowed to wear, they will wear toward the Go gages, in the direction of increased tightness, and will reject work that is within the product limits.

Because of this unavoidable wear of gages it is regarded as good practice to provide for it by starting out with Go gages that are somewhat inside the product limits; that is, slightly on the Not Go side of the low limit of the hole and the high limit of the shaft. This practice, of course, reduces by an equivalent amount the tolerance available for the product, but it guards against too tight a fit, or non-assembly of the product. For the same reason, Not Go gages are made as close as possible to the product limit.

Since the Not Go gages wear toward the Go gage limits and in the direction of increased tightness, the wear of Not Go gages reduces the amount of tolerance that can be used on the product. For this reason it is advocated by some that the Not Go gages be allowed to be outside the product limits when new, since they will soon wear inside the limits. This practice, however, is inconsistent with the basic assumption that the object of gaging is to insure that no work accepted by the gages is outside the product limits. If it is desired to provide for wear on the Not Go gages, it would seem to be better policy to increase the product tolerance by a sufficient amount to compensate for the permissible error in new Not Go gages and then to adhere strictly to the basic principle of gaging limit on gages are considered, the advantages of the unilateral system are still further apparent.

Reverting to the example already given, the limits for the hole were 1.000 in. and 1.002 in., and for the shaft 0.999 in. and 0.997 in. Suppose it is decided to put a wear allowance of 0.0003 in. and a tolerance of 0.0002 in. on the Go gages, and a tolerance of 0.0002 in. on the Not Go gages. As already pointed out, no wear allowance should be provided on Not Go gages, because of the direction of wear.

Under the unilateral system, the limiting dimensions for all gages, both Go and Not Go, can be written down at once. Under the conditions stated they will be as shown (indicated in inches) in Table 1.

It is seen that the effect of the gage tolerance and wear allowance is to reduce the product tolerance, so that the net amount available for use on the product may be as small as 0.0013 in. for each member, while if all gages are as close to the product limits as is permitted, the reduction will be only that introduced by the wear allowance of the Go gages, and the net tolerance will be over 0.0017 in. for each member.

It would, of course, be possible to set up the above example in terms of bilateral tolerances, but under that system the nominal, ideal, and limiting sizes of the product and of the gages would become so involved, complicated, and confusing that I shall not go to the trouble of doing it but will leave that for some advocate of the bilateral system.

The principles outlined above apply also to the gaging of screw threads. The problem of dimensions and tolerances is, of course, much more complicated because of the additional elements involved. Errors of lead and angle in both product and gages must be considered in addition to errors of diameter.

Fatalities Due to Falls Show Need for Walkway Safety Code[1]

by

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What is the matter with our walkway surfaces? Why should there be approximately 17,000 fatal accidents due to falls in the United States in a single year, with about 50 per cent, or 8500 fatalities, on walkway surfaces? The answer must be that we need better walkway surfaces and a code to act as a guide or yardstick by which engineers and architects may know the relative safety merits of various walkway surface materials, and be required to select proper materials for installation, according to the conditions and use pertaining to each installation.

The fact that a great many walkway surfaces are unsafe has long been recognized by engineers, architects, insurance companies, and others. This is evidenced by the fact that, as far back as the year 1923, a sectional committee organized by the American Standards Association at the request of the American Society of Safety Engineers and the American Institute of Architects, as sponsors, started deliberations looking forward to the formation of a code for safe walkway surfaces.

The importance of this subject is further emphasized by the fact that 38 national bodies are represented on the committee, among them being representatives of the steam and electric railway industries, the American Institute of Architects, the American Society of Civil Engineers, the American Society of Safety Engineers, the American Society for Municipal Improvements, utility corporations, the Association of Governmental Labor Officials of the United States and Canada, the Building Officials Conference, the National Bureau of Casualty and Surety Underwriters, insurance companies, manufacturers, the Underwriters' Laboratories, and the Departments of Commerce and Labor, the Navy Department, and Treasury Department. This committee, of which the writer is a member representing one of the railway groups, has gathered many pertinent facts and much valuable information on this subject, but it has published nothing.

The importance of a code for safe walkway surfaces cannot be too highly stressed. This is brought home in a striking manner when we consider that the records of the United States Bureau of Vital Statistics for the year 1928 show that throughout the United States there were 16,893 deaths resulting from falls, while in more recent years this figure runs well over 17,000 per year. At this point it would be well, perhaps, to cite, for the purpose of comparison, the fatalities occuring from other sources. During the year 1928, for instance, there were throughout the United States 1845 deaths resulting from conflagration, 2285 from machinery or mechanical accidents, 1657 from street car accidents, including collisions with automobiles, 2229 from scarlet fever, 8263 from diphtheria, 131 from smallpox, and 5620 from typhoid fever.

Of the number of casualties due to falls, it is, I believe, fair to state that 50 per cent of these occur on walkway surfaces. Based on experience in New York City for the year 1929, we find that of a total of 1088 fatalities from falls, there were only 12 from ladders, 32 from scaffolds, 41 in building construction, and yet there were 545, or more than 50 per cent of the total killed, on stairs, floors, and street surfaces. In this city, there were nearly 12 times as many fatalities from falls on walkway surfaces as in fires; twice as many as from typhoid fever, chickenpox, measles, scarlet fever, diphtheria, tuberculosis, and cancer, all combined.

There are more than 70 compensable cases for each fatality, and based on the average cost of such cases in the state of New York last year, which was $410 per case, the cost of falls throughout the nation for last year was in excess of $487,900,000. This cost is reflected in our industries, because the cost of accidents is a direct charge against production and in the final analysis is one of the numerous charges that increase the cost of living. It is, therefore, of vital interest to our industries and the public alike to bend every effort to reduce the hazards which contribute so largely to the waste in industry and the increased cost of living.

The sectional committee which was organized to prepare the safety code for walkway surfaces

[1] Reprinted from the *National Safety News*, October, 1931.

[2] Mr. Burke represents the American Electric Railway Association on the Sectional Committee on Safety Code for Walkway Surfaces (A22).

found that the data available on walkway surfaces and materials was, in their opinion, inadequate for the formulation of a satisfactory code, and they therefore appealed to the manufacturers for the desired information. As a result of this request, a manufacturers' subcommittee, composed of manufacturers and distributors of walkway materials, was organized, and through them arrangements were made, in 1924, for a research fellowship at the National Bureau of Standards at Washington to conduct experiments in an effort to determine the frictional resistance values of walkway surface materials.

The investigation brought about the development of an apparatus and process for preparing specimens of walkway surface materials for frictional measurements and an apparatus and methods for measuring the coefficients of friction. A report of this investigation was submitted to the manufacturers' subcommittee in 1926. Subsequently, the Bureau of Standards deemed it advisable to conduct a further and independent investigation, which has been completed and the results published as research paper No. 204 of the United States Department of Commerce, Bureau of Standards, entitled *A Method of Measuring Frictional Coefficients of Walkway Surfaces.*

While research paper No. 204 of the Bureau of Standards is very enlightening as to the apparatus and method of measuring the coefficients of friction on walkway surface materials, it fails to give the frictional values of any specific materials, but groups various materials together, assigning a letter to each group of materials, and then proceeds to give the frictional values of these groups, but still without naming the group or giving the general classification of the material.

What is needed is a tabulation setting forth the frictional value of each specific material used in walkway surfaces and a code which will be enacted into law designating the minimum coefficients of friction required in designated locations and under stated conditions. This tabulation should contain the frictional values of the various materials under dry, wet, and oily conditions. With such a tabulation of frictional values, and a code by which minimum frictional values are required, there is no doubt that a great step will have been taken toward the elimination of slipping hazards on walkway surfaces, for then, and then only, will architects and engineers be able to determine intelligently what materials they can use that will provide safety under any given service conditions.

In the absence of a code and tabulation of frictional values, it would perhaps be well to review some of the conditions that create tripping and slipping hazards, and some of the ways of avoiding them. In the first place, it should be realized that these hazards give no warning of their presence and for that reason they are often, to a large extent, ignored. Were they noisy, as in the case of a machine or a grinding gear, we would undoubtedly go to a great length in providing adequate guards so as to avoid accidents, but where the hazards do not keep calling to us constantly, we ignore the danger, although it is ever-present.

Tripping hazards are usually caused by the presence of vertical projections on walkway surfaces, and any projection, even as small as one-eighth inch, above the plane of contact with the sole of the shoe may be a tripping hazard.

Safety Magazine Asks for Early Completion of Safety Code for Walkway Surfaces[1]

In applying safety engineering protection for the prevention of accidents, the need for and use of a safety code is not an uncommon requirement. Many safety codes have been promulgated and are now performing valuable service in the accident prevention movement. The need for a safety walkway code has been apparent for many years but so far none has been forthcoming, with the result that there is no guiding code to help establish a safer walkway condition.

[1] Reprinted from *Safety Engineering,* September, 1931.

It seems right to inquire why there has been such a long delay in perfecting a walkway safety code. A review of the walkway code situation does not seem to give us an answer.

Briefly the situation is this: Some nine years ago the American Institute of Architects and the American Society of Safety Engineers jointly petitioned the American Standards Association to undertake the formulation of a walkway safety code. A general conference was held in New York City in February, 1923, to which all interested organizations were invited to send

representatives. It was attended by delegates of some 40 national bodies. It was unanimously voted that such a code should be developed.

Due to the lack of an adequate method of measuring frictional resistance, considered essential in walkway safety, reasonable time was necessary to establish this requirement. By 1926 the Bureau of Standards had solved this problem and had made recorded measurements on some 148 different types and specimens of walkway and flooring materials. This data was furnished to a manufacturers' subcommittee five years ago. Has the manufacturers' subcommittee yet furnished the code committee with this data with permission to use it? If so, has the code committee utilized it?

This list of 148 walkway and flooring materials with their measured frictional coefficients should be valuable to architects and engineers to guide them in the selection of safe materials to lessen the hazards of walkways.

To avoid slipping hazards, it must be borne in mind that all walkway materials are not suited for use under all conditions and great care must be exercised in selecting the proper material for each specific installation. In selecting the type of material, it is also essential to determine whether or not the surface of the material as eventually installed will be always dry, or whether it may be wet or oily, and the circumstances under which it is to be used should also be borne in mind.

Ramps and inclines should provide higher frictional resistance values than level surfaces and the frictional resistance should be increased as the grade of the ramp increases. When a granolithic finish is to be used, an abrasive should be floated into the surface. This practice has been found to produce good results and is used by the Board of Transportation of the City of New York for all such surfaces as well as for the surfaces of platforms. This Board requires about one pound of eight-sixteenth aluminum oxide abrasive per square foot of surface. In some installations strips of safety tread extending at right angles to the line of traffic and set in cement, flush with the surface of the walkway, have been employed, while in other installations specially designed tile has been successfully used.

Stairways are undoubtedly productive of the greatest number of accidents. In designing stairways, the following items should be carefully considered:

Single runs of stairs should not exceed eight feet vertically.

Treads on stairs should be of sufficient strength to bear the maximum number of people who can stand upon them and there should be provided a factor of safety of six.

The width of treads and height of risers should be constant for each run of stairs, the tread being of sufficient width to allow ample space to place the whole length of the foot. They should not, however, exceed 12 inches in width, including the nosing overhang which should be from seven-eighth inch to $1^1/_4$ inches.

The angle of the stair should be between 30 degrees and 36 degrees and the best formula for determining the height of the riser in inches is as follows: 25 inches minus tread width, divided by two, equals riser height.

Headroom on stairways is another important feature and it is well to provide a minimum distance of not less than seven feet from the top to the tread, on a vertical line with the face of the riser.

The type of material used for treads on stairs is of the utmost importance. In this connection, it should be borne in mind that the hazards on stairs used entirely for ascending purposes are quite different from those on stairs used for descending purposes solely. On stairs used for ascending, the wear is at about the center of the tread; that is, between the nose and the rear of the tread; while on the descending stairs, the wear is toward the front and the very nose of the tread. While grooved treads may be satisfactory on a stair used for ascending, they are objectionable on descending stairs if they are parallel and within three inches of the nose, as the heel of the shoe, especially a lady's shoe, may catch in one of these grooves, causing a person to fall headlong down the stairs. Lighting is also of vital importance, especially on stairs, where lights should be so arranged as to furnish uniform illumination and at the same time shaded so as to prevent the rays of light from striking a person in the eye, causing impaired vision and resulting in taking uncertain steps.

It has been claimed that many of the stair casualties are not the result of structural conditions or type of material used, but are the result of human deficiencies, such as vertigo, poor eyesight, impaired reflexes, relaxed muscular tissues, carelessness, etc., but compare this statement with the fact that during the year ending June 30, 1929, in the Times Square Station of one of the New York City subways, there was an exposure of approximately 114,000,000 persons with only 115 reported accidents, with less than one-tenth of these resulting in injury. This total includes all reported falls, including those where the individual immediately got up and walked away. Forty stairways and some considerable area of horizontal walkway surfaces took care of this enormous traffic, unequalled perhaps anywhere in such a small area, with such an exceptional degree of safety. A careful inspection discloses no noticeable external physical hazards,

and conditions are as safe as human ingenuity could devise. The result, one accident per million separate exposures, shows that human deficiencies are in reality a negligible factor in causing falls of persons.

In order to accomplish the elimination of tripping and slipping hazards, we should keep in mind constantly and attack relentlessly those hazards that are most productive of serious casualties. For, in the final analysis, hazards must be removed if serious casualties are to be prevented, and the prevention of the hazard is the only sure and permanent cure.

The Bureau of Standards conducted a further and independent investigation in 1928 and 1929, "to review, after the lapse of considerable time, the data and methods originally employed, and to examine these data as to their usefulness as a basis of evaluating the effectiveness of various materials in relation to the walkways safety problem." The United States Department of Commerce published a report of this investigation as Research Paper No. 204, pointing out that "characteristic differences in frictional properties of walkway materials are shown by their coefficients of friction, measured under dry, wet, and oily conditions, which indicate the tendencies of the materials to become slippery under various service conditions."

It is regrettable from an accident prevention standpoint that up to the present no specific list of materials with their measured frictional coefficients has been made available and no walkway safety code has been made available and no walkway safety code has yet been promulgated. It would seem that the continued delay of perfecting and promulgating a walkway safety code points to conflicting commercial interest, but we venture to state that safety standards should not be withheld for any reason because it means a retardation of safety efficiency, and accidents occurring through the lack of safety guidance. Either a suitable code should be developed and promulgated without further delay or the present committee should be discharged and the project placed in the hands of a new committee of unbiased engineers, government specialists, and consumers, free from interference, who will lose no further time in providing this needed code.

Purchasing Agents Discuss Buying on Specifications

"Do you favor purchase on specifications?" was one of six questions asked by George A. Renard, secretary-treasurer of the National Association of Purchasing Agents, at the Sixteenth Annual International Convention of the Association held in June in Toronto, Canada.

The question was answered by W. E. Campbell, purchasing agent of the Frigidaire Corporation, and by C. E. Smith, vice-president on purchases and stores, of the New York, New Haven, and Hartford Railroad Company.

The complete question as phrased by Mr. Renard was:

> "Do you favor purchase on specifications? Who should develop the specification, producer or consumer? Which is more satisfactory, performance specifications or analytical specifications detailing the materials and methods to be used? Should specifications eliminate trade-marked or branded material? Many of them, including the government, eliminate brands entirely, except as they are offered and supplied in accordance with their specifications."

Mr. Campbell, replying, said:

> "Purchasing by specifications. This seems to be by far the most satisfactory method of buying, since there is no chance for misunderstanding—everything is in writing, all sources can quote equitably, each having the same information as the other.
>
> "Some sources of supply, in their eagerness to tie up business so that they are the only ones who can furnish it, are glad to write specifications and, of course, the buyer does not find out until after the specification has been written that the competition has been eliminated from the specification by the person who wrote it up.
>
> "There are two types of specifications. There are those which require that the material must do the work intended; this, of course, is a method of having the source of supply do the work which the purchaser's company should do. On analytic specifications, if the material meets certain specifications which are more or less easily determined, it is then up to the buyer to work out the fitness of the material for the purpose intended."

Mr. Smith in his reply said:

> "Do you favor purchase on specification? Yes, whenever possible, but unfortunately, regardless of all our technical knowledge, it is not always possible nor practicable to describe on paper or plans the quality and service of materials that can only be proved in actual service or by actual test. Here trade names and reputations of standard brands of reliable manufacturers will in many cases be preferable

to purchasing on specifications. Naturally many items will fall within the class that can be purchased better on standard specifications, and I believe this should be resorted to, to the maximum practicable extent. But, regardless of all our efforts in that direction, there will be many items that can be purchased better without specifications, and if you have my experience you will continue to buy many standard trade brands in competition with your specification material.

"Of course, the consumer should develop his own specifications to avoid producers so preparing specifications as practically to specify their own products by description if not by name. But there will be many cases where a specification prepared by a consumer will be entirely satisfactory if approved by the purchaser.

"Performance specifications are to be preferred in some cases to descriptions of the materials and methods to be used in production, but not in all cases. Where specifications are used I believe it goes without saying that trade-marks and branded materials should not be referred to by name, because I believe it to be wholly unfair to those companies who have spent large sums in developing and advertising branded products and standard goods to request their competitors to bid on such products or their equivalent."

Regulations of the National Fire Protection Association

The National Fire Protection Association has recently prepared the following proposals for regulations covering phases of fire protection:

Tentative Regulations for the Design, Installation, and Construction of Containers for the Storage and Handling of Liquefied Petroleum Gases—These regulations are the first rules initiated by the National Fire Protection Association covering the construction and use of unfired pressure containers and are particularly significant because of the complex nature of the containers and the properties of the materials they are intended to contain. The regulations cover application of rules, storage container classification, working and test pressure for storage containers, capacity of cylindrical containers, storage container specifications for above or below ground installations, location of storage containers, installation of storage containers, dikes and embankments, fencing, piping, filling pipes and discharge pipes, safety devices, vaporizer and housing, liquid level gaging devices, valves and connections, filling densities, transfer of liquid, painting, holders.

These proposed regulations are in tentative form, and are now being circulated for the purpose of securing comments and criticisms.

Recommended Good Practice Requirements for Fire and Life Safety in Aviation—These requirements, prepared by the Committee on Aviation of the National Fire Protection Association, cover the arrangement and construction of airplanes, power plant and electrical equipment, fire extinguishing systems in airplanes, procedure for inspection, maintenance and repairs of aircraft, and operation of airports. The recommendations have been worked out in such a way that they can be used by all interested in safety in aviation, by the designer, manufacturer, pilot, ground men, and mechanics, according to the introduction to the pamphlet prepared by the N.F.P.A. Because of the changing nature of the industry, the committee of the N.F.P.A. in charge of the project will welcome suggestions and criticisms from any one interested.

Regulations for Outside Protection, Private Underground Piping Systems Supplying Water for Fire Extinguishment—These regulations, proposed by the National Fire Protection Association, have been adopted and published by the National Board of Fire Underwriters. They cover the general details of underground piping systems supplying automatic or open sprinklers, yard hydrants, monitor nozzles, roof hydrants, or standpipes. The subjects covered include water supplies, valves, hydrants, heavy calibre hose streams, underground pipe and fittings, rules for laying pipe, and instructions for testing.

Single copies of all of these regulations can be obtained free of charge from the National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts.

German Standards for Residence Construction

Construction of Residences, a new German handbook (DIN Taschenbuch 18) containing over 200 pages of technical data of interest to builders of private homes, has just been received at the ASA office. This book reproduces German standard (DIN) sheets showing dimensions of windows and doors, construction of stairs, electric wiring rules, requirements for heating and plumbing, and includes several pages of standard symbols for use on plans.

Copies may be borrowed for review, or purchased for three dollars through the ASA office.

Expert on Governmental Purchasing Discusses Buying on Specifications

Professor Russell Forbes cites important savings in municipal and institutional purchases

Two recent papers by Russell Forbes, secretary of the National Municipal League, director of the Municipal Administration Service, and Associate Professor of Government at New York University, will have definite value and interest to engineers and purchasing agents concerned with standardization.

In his paper in *The Purchasing Agent* for February, 1931, Professor Forbes reports purchases on fire hose by six municipalities having city managers. The bids received on definite specifications (Underwriters' Standard) resulted in the order being placed at a price of 64 cents per foot delivered to the using municipalities, at a time when other Michigan cities were purchasing fire hose of similar size and quality at $1.30 per foot. The joint specification purchase provided a saving of more than $3000.

"How can this saving be explained? First of all, by the fact that the combined requirements of the six cities constituted a wholesale order and therefore stimulated keener competition. In the second place, the hose purchased in this way bore no trade-mark, but only the label of the Underwriters' Laboratories. Since practically all fire hose bears the Underwriters' label, some of the price difference can be attributed to the trade-mark, for which the producer maintains a uniform price high enough to cover sales promotion costs. It is well known that fire hose producers spare no expense or effort to distribute their goods and that the pressure brought to bear on municipal buyers is at times terrific. A third reason for the saving was the fact that the order was secured with no sales expense except that of submitting a bid by mail.

"The first hose was inspected during manufacture and was delivered in August, accompanied by a notarized inspection report from the Underwriters' Laboratories. The cost of inspection was borne by the vendor and was presumably included in his bid. Inspection reports showed that the hose was from 40 to 50 per cent above specifications."

As other cities became interested in the possibilities shown by this case, a second lot of fire hose, totaling 7300 feet, was purchased for 12 municipalities, this time at a price of 61 cents to 64 cents per foot. The Michigan Municipal League is now planning to buy staple commodities, such as chemical hose, chemicals, etc., on a cooperative basis, and it is predicted that the savings demonstrated in fire hose will be paralleled in other commodity lines.

Professor Forbes cites the case of the Hospital Bureau of Standards and Supplies of New York City which has arranged about 50 price agreements covering staple items used in common by most of its members. Savings average from 10 to 40 per cent according to the commodity and quantity purchased. In this case, because the needs of the constituent members differ considerably, specifications are usually prepared for two or more qualities of a given article.

A similar situation exists in the Business Secretaries' Association of the Y. M. C. A.'s throughout the country, which carries out joint purchase agreements, based on standards, for more than 400 commodities.

"Cooperative purchasing for cities has long been deemed impracticable because of the obstacle of standardization. The writer believes that almost any group of cities can agree on the essential elements of a standard specification. The details need not be agreed upon *in toto*. In almost any given commodity line, which is produced in several qualities, a contract can be negotiated by which an approximate total quantity is purchased, with a different price for each shade or variety of quality. This would permit any city to order its own precise quality preference, and, by pooling its needs with other cities for the same article, to secure wholesale prices for retail quantities. Thus the small city can become a 'big buyer' and secure unit prices comparable to those secured by large cities, even though its individual purchases are small.

"Large private corporations, with several branch factories or branch purchasing offices, are now tending toward centralized contracting for, instead of centralized purchasing of, staple commodities. The central purchasing office of General Electric, for ex-

ample, enters into the contract for staple items after preparing the specifications, canvassing the field of supply, determining the proper length of time of the contract based on the market outlook, and securing what it considers the best price, quality, and service agreement. A copy of such contract is sent to each branch purchasing office, which places the orders, inspects and tests the deliveries, and approves the claim for payment. Articles which are not common to the needs of all branches and which may be purchased locally to good advantage are procured by each branch office as need arises.

"The League of Minnesota Municipalities is now considering the possibility of establishing a central information service on specifications and current prices for the staple commodities used by its member cities. The plan would contemplate the preparation of standard specifications for the 25 or 50 commodities which constitute the largest purchases of Minnesota cities. Copies of these specifications would then be furnished to all member cities and each specification would be coded. Vendors would then be asked to submit to the secretariat of the league prices for varying quantities of a given article, with quality as stated in the specification. This price information would then be transmitted monthly or quarterly to the buying officials of member cities, but naturally would not be broadcast to the public at large."

In the second article, which appears in a pamphlet available from the National Association of Purchasing Agents, Professor Forbes, in dealing with the subject of "Centralized Purchasing, a Sentry at the Tax Exit Gate" says:

"Centralized purchasing in government is the delegation to one office of the authority to purchase supplies, materials, and equipment needed for use by all the several branches of the organization. It is neither a fad nor a theory but a combination of logic and economics. It may well be called a sentry at the tax exit gate.

"To carry on the functions of the present-day government, a veritable host of commodities is needed. It has been estimated on good authority that the average hospital uses 1500 different items. Hospitalization is only one of scores of modern governmental functions, and so we find on the shopping list of many governments thousands of articles, ranging in size from thumb tacks to steam rollers, and alphabetically from apricots to zithers. No government has ever been so fortunate as to receive these commodities free of charge. They are obtained only in exchange for public funds. In the average government the expenditures for supplies, materials, and equipment consume from 20 to 30 per cent of the current operating budget each year. In some governments, the proportion is even higher. It is estimated that the governments of the United States—federal, state, county, and municipal—spend at least one billion dollars per year for supplies, materials, and equipment."

An elaborate table too lengthy to include here shows the decrease in unit prices obtained through centralized purchasing in the State of Maryland. It will be of interest to any one desirous of determining for his own industry or trade group, or governmental bureau, what can be done by purchase on stated requirements through an office centralizing the necessary knowledge and technique.

Another table shows an average saving of more than 45 per cent during the last three years on 30 items of school supplies.

The universal value of this method of purchase through research and specifications is evident from the following homely illustration:

"After trying various brands of fly spray we finally succeeded in finding one brand which seemed to give universal satisfaction in all institutions. The price of this spray, however, seemed excessive and after analyzing it in our laboratory we drew up a specification (P. & S. D. Specification No. 16), had a small quantity of this spray made under this specification, and distributed it to each institution for trial.

"The spray made under our specification was entirely satisfactory to all institutions and we therefore made an annual contract for same to be delivered as required, at a saving of 45 per cent under the cost of the branded spray which was duplicated."

Another case involving larger sums was that where coal was bought on definite specifications and for combined requirements, permitting a single city (New London) to save more than $3000 over retail prices.

On the subject of "Standardization and the Adoption of Standard Specifications" Professor Forbes says:

"Without standardization, centralized purchasing falls short of its real function. If each branch of the government is allowed to demand its own particular choice of brand or quality, it is impossible to consolidate requirements into bulk orders. In that case, the advantages of price reduction through bulk buying will be lost.

"Admittedly, all articles used by a government cannot be standardized. Nor can all using agencies be expected to use the same quality of a commodity. One or more departments may require a higher quality or a different style of article than will serve the needs of other departments. But almost any government buys scores of articles which are used in common by the various departments and institutions; among these may be mentioned coal, paper, stationery, furniture, motor equipment, automotive accessories, gasoline, motor oil, and textiles.

"Standardization has many other advantages besides price reduction . . . better delivery service. . . . Transfers of stock between departments can be more easily effected. . . .

"It should be pointed out, however, that, to be successful, a standardization program should be based on consultation with the using officials. No purchasing official should be given blanket authority to establish standards according to his own personal beliefs. Standardization, to be satisfactory, must be based on accurate and complete information on the needs of the using agencies and should be made to conform to the economic rule of the 'greatest good to the greatest number.'

"Ancillary to the adoption of standards is their expression in written specifications. Specifications make real competition possible. If the needs of the government are expressed in clear and unmistakable language, the bidder can submit a more intelligent price quotation; the purchaser can make a more accurate comparison of the bids received from various sources to determine which is best; and the inspector can determine whether or not the government is receiving what it ordered.

"Without definite written specifications, most governments are compelled to ask for prices and to award orders on the basis of trade-marks, by citing a well-known brand 'or its equivalent.' Quite naturally, indefinite language of this sort leads often to substitution of inferior quality and to litigation over disputes on deliveries. Wherever possible, written specifications should be prepared, including definite quality and performance tests as the basis for acceptance and payment of the delivery.

"The preparation of specifications is a technical task requiring the combined services of the engineer, the chemist, the lawyer, the buyer, and the user. Consultation with the seller, too, is frequently helpful, especially in determining whether the proposed specification is practicable from the producer's standpoint. The specification should not be too drastic and rigid, lest it increase the cost by interfering with normal production methods.

"Abundant proof of the advantages of standardization is found in the experience of many governments—federal, state, and local. By reducing the varieties and increasing the volume, the state purchasing office of Maryland has been able to secure the lowest possible prices. Under decentralized purchasing in Maryland, 17 different brands of toilet soap and 15 different brands of scrubbing soap were used by the various state departments and institutions, so diverse was their individual preferment. Through standardization, the purchases of the state are now limited to three kinds of toilet soap and two kinds of scrubbing soap.

"New standardization projects are initiated from time to time in Maryland. Recently a conference between the purchasing agent, the heads of the different state institutions, and representatives of the manufacturers resulted in the reduction of the different kinds of mattresses used by the state from eight to four and of pillows from eight to three different kinds. Specifications have been prepared so that in the future all manufacturers will be able to bid on the same articles and will not be required to submit samples with their bids.

"Before the purchasing department was established for the city of Los Angeles, the individual departments paid from 75 cents to one dollar each for high quality typewriter ribbons. By standardizing on one grade, and by contracting for a six-month supply, the price was reduced to four dollars per dozen. By the adoption of standard specifications and by broadening the field of competition, the city now pays $2.41 per dozen for precisely the same grade of ribbon which previously cost four dollars per dozen.

"In Detroit, prior to 1918, approximately eighty different types of oils and greases were used by the city government. As a result of careful chemical tests, the number of types used was reduced to ten, and definite specifications were prepared to describe the standards. It is estimated that the city saves $25,000 per year through the standardization of this commodity.

"In Cincinnati, too, standardization is progressing steadily. In 1929, a total of ninety-two new specifications were prepared, tried out, and finally adopted for city use. One of these covered surgical soap. By a six-month contract and the use of the new specification, the competition was widened and the price was reduced from

9.25 cents per pound to 7.85 cents per pound. The standard specifications for chipped soap brought a reduction of 17 cents per hundred pounds over the 1928 price, in the face of a rising market. During 1928 the city paid $3.49 per hundred pounds for soap powder of a certain trade brand. After the adoption of the standard specification, the same powder was purchased without trade label for $2.74 per hundred pounds.

"The city of Milwaukee has gone a long way in standardization of its material requirements. Recently the city purchasing agent prepared specifications for the purchase of fireworks for the annual Fourth of July celebration. These specifications, believed to be the first of their kind, enabled the city to compel suppliers to furnish what was ordered. Another progressive step in Milwaukee was the recent adoption of specifications covering the removal of metals sold by the city to scrap dealers. The new requirements are believed to give a most accurate check on the buyer and to insure the city's receiving full payment for the scrap sold.

"Los Angeles County, California, has two regular standardization committees. The committee on standardization of stationery consists of the auditor, the recorder, the tax collector, the assessor, the purchasing agent, and a representative of the bureau of efficiency. The committee meets when occasion demands and considers revision of existing standards or new non-standard items which seem to have utility for county use. The institutional standardization committee meets once per month in the office of the purchasing agent. These meetings furnish opportunity for the institutional heads to discuss their matériel problems with the purchasing and stores officials. New standards are decided upon or old standards are revised. The minutes of these meetings are furnished to all officials who attend and provide a running story of standardization procedure in the county government."

Under the subject "Centralized Supervision over Material Following Delivery" Professor Forbes discusses the advantages of centralized purchasing in providing better and more thorough inspection of deliveries. Under the old decentralized system,

> "deliveries are usually inspected by rule-of-thumb methods, thus opening the door to substitution of quality by the vendor, short-weighting, or any other device to escape supplying what was ordered."

With the establishment of centralized purchasing under specification, specialized inspectors become a possible adjunct. In Detroit, for example, six such inspectors are attached to the office and each examiner is a specialist in certain commodity lines. In case of doubt he provides for samples and arrangements for physical or chemical tests. The purchasing department here, through the use of specifications, is enabled to employ the services of the community laboratory, a commercial testing laboratory, and the laboratories of many private corporations. During 1929 a total of 2168 samples were taken. One hundred and twenty-six were found unsatisfactory and deliveries were rejected. As Professor Forbes says:

> "There is no way of telling how much was saved to the city through this inspection system; but it would probably be conservative to estimate that the total saved was greater than the cost of the inspection system for several years."

In the State of Washington, the state department of agriculture inspects all hay and grain purchased by the State; the state highway department tests oil and gasoline. Coal is purchased on the Btu basis, and all deliveries are subjected to sampling and test.

In Maryland, the State uses the services of the official flour inspector of the Baltimore Association of Commerce, and no institution will accept any flour in the market without the inspector's name as a certification of its having been inspected and found acceptable.

> "A purchasing department responsible for the matériel problem of a government," says Professor Forbes, "can well afford to watch commodities in action and to base future awards upon the service records of present purchases. Data on such tests are of incalculable help in deciding what is the lowest and best bid on future orders.
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> "A careful and satisfactory system of inspection may be carried on without centralized purchasing. But experience has shown that inspection is seldom adequate in the absence of purchasing officials who are solely interested in getting one hundred cents of value for each dollar of public funds expended. It is unfortunate but true that many purchasing systems provide no adequate system of inspection. Even though the buying technique be of the highest calibre, centralized purchasing may fail unless accompanied by careful inspection whereby the government can be assured of receiving what it buys and pays for."

In his conclusion Professor Forbes says:

> "The potentialities of this system of buying cannot be overlooked in any plan for

economy and efficiency in public administration. 'Scientific purchasing is a preeminent characteristic in distinguishing a good government from a poor one.' "[1]

F.J.S.

New British Standards for Sampling and Analyzing Coal

The British Engineering Standards Association has recently published a new standard covering methods for the sampling and analysis of coal for inland purposes (B.E.S.A. No. 420–1931). This standard, appearing less than a year after the publication of B.E.S.A. No. 404-1930, which deals with coal for export, covers recent developments of practice in the sampling and analysis of coal. In the British standards, the emphasis placed on certain features differs from customary American practice as given in the American Standard, X1-1921 (A.S.T.M. D21-16).

In developing these standards, advantage has been taken of recent research work by British engineers. The essential features of this research are indications that the weight of the sample required is regulated by the ash percentage as well as the size of the particles of coal. In accordance with this postulate, the new standards divide coals into five classes and three sizes. The percentages of ash in the five classes is approximately as follows:

Class A—below 6 per cent
Class B—6 to 10 per cent
Class C—10 to 15 per cent
Class D—15 to 20 per cent
Class E—over 20 per cent

The sizes considered are one-inch, two-inch, and three-inch mesh. Sampling increments and the minimum total weight of the final sample are varied to meet these specified conditions.

Although these specifications may be entirely suitable for British conditions, American engineers are not likely to favor a decrease in the weight of either the individual sampling increments or the total weight of the sample, such as are specified in the British standards. When followed, the American standard will give representative samples from the wide range of American coals to which its procedure is being applied.

Copies of the British standards are available for loan to interested parties by the American Standards Association.

[1] John W. Sheedy, "City Purchasing," *Public Management*, February, 1929, page 63.

B.E.S.A. Publishes New Electrical Standards

The British Engineering Standards Association has published the following new standard specifications:

British Standard Specification for Tubular Traction Poles, No. 8–1931—This specification covers steel poles of the type ordinarily used in trolley line construction.

British Standard Specification for Electric Cut-Outs, Type O, No. 8–1931—Five sizes of cut-outs intended for use in two, three wire, or multi-phase circuits in which the rated current does not exceed 100 amperes or the nominal voltage does not exceed 250 volts to ground are covered.

British Standard Specification for the Electrical Performance of High-Voltage Bushing-Insulators, No. 223–1931—Insulating terminal bushings for indoor and outdoor use in the voltage range from 0.6 kv to 220 kv of all types except the separable plug and socket type are covered in these specifications.

British Standard Specification for Ebonite for Electrical Purposes, No. 234–1931—Ebonite in the form of sheets, rods, or tubes is covered by these specifications.

British Standard Specification for Street Lighting, No. 307–1931—These specifications provide a basis upon which highway (street) lighting installations can be designed, installed, and tested. They also specify the technical conditions applying to the maintenance and testing of such installations under service conditions.

British Standard Specification for Apparatus for Workshop Testing of Permanent Magnets, No. 406–1931—The specifications deal with the essential details of the construction and operation of apparatus suitable for use in workshops for the testing of permanent magnets, such as those used in magnetos. Other magnets within the limiting dimensions specified in the specifications are also covered.

British. Standard Specification for Mains Supply Apparatus for Radio and Acoustic Reproduction for use on Alternating-Current Mains, No. 415–1931—These specifications apply to devices for supplying current to apparatus employing thermionic tubes for radio or acoustic reproduction purposes where the energy is derived from an alternating-current supply. Definitions, rating, marking, construction, etc., are covered and in an appendix a definition of grade or

quality of the supply apparatus as regards "output hum" is given.

1931 Book of A.S.T.M. Tentative Standards

The *1931 Book of A.S.T.M. Tentative Standards* (1008 pages) containing 180 tentative specifications, methods of test, definitions of terms, and recommended practices in effect at the time of publication, has just been published. The term "tentative" applies to a proposed standard published for one or more years, with a view to eliciting criticism, before it is formally adopted as standard by the Society.

This volume contains a comprehensive subject index and a table of contents which lists the respective standards under the various materials covered. In addition, a complete list of all the standards and tentative standards of the Society in effect September 1 is included.

The 42 new tentative standards which have been developed this year are published in the *1931 Book*. In the ferrous metals group are specifications for structural steel for ships, heat-treated carbon-steel helical springs, carbon-steel forgings and normalized and tempered alloy-steel forgings for locomotives, various types of steel pipe, including electric-fusion-welded, electric-resistance-welded, forge-welded, and lock-bar steel pipe. There is also a tentative specification for riveted steel and wrought-iron pipe. Specifications involving non-ferrous metals include magnesium-base alloy castings, copper-base alloys in ingot form for sand castings, aluminum-base and zinc-base alloy die castings.

In the non-metallic materials field there are specifications for sand for use in lime plaster; gypsum wall board, gypsum lath, and sheathing board. There are many new important standards in the concrete field, including concrete aggregates and several methods of curing Portland cement concrete slabs. Tentative methods of test are given for apparent specific gravity of coarse aggregates in a saturated condition, structural strength of fine aggregates using constant water-cement-ratio mortar, and tests for the soundness of fine and of coarse aggregates by use of sodium sulphate.

The building industry will be especially interested in specifications and tests for load-bearing concrete masonry units. New specifications in the preservative coatings field include specifications and tests for soluble nitrocellulose and acetone. There is a tentative method of test for vapor pressure of natural gasoline (Reid method).

Rubber products involved are cotton rubber-lined fire hose (ASA L3-1929), steam hose, and rubber pump valves. There are several tentative specifications involving textile materials, such as tolerances and test methods for rayon, enameling duck for the tire industry, and Chafer tire fabrics.

Copies of the *Book of A.S.T.M. Tentative Standards* may be obtained from the headquarters of the Society, 1315 Spruce Street, Philadelphia, Pa., or through the ASA office. The price is seven dollars for paper binding, eight dollars for cloth binding.

Classification of Wool and Part-Wool Blankets

At a meeting of a general conference held in New York City on November 20, 1931, under the auspices of the National Bureau of Standards, the proposed commercial standard relating to the classification of wool and part-wool blankets recommended by a group of leading manufacturers and by the National Retail Dry Goods Association was considered and adopted by the various interests represented. In connection with this standard the conference voted to set February 1, 1932, as the date for the recommendations to take effect and for labels to show the percentages of wool in the finished blankets in accordance with the standard classification. This applies to blankets as delivered by manufacturers.

The conference also voted to submit this standard to the American Standards Association for consideration for approval as an American Standard.

Simplified Practice Recommendation on Abrasive Grain Sizes

Simplified Practice Recommendation R118–30 on abrasive grain sizes, which establishes a table of allowable limits for the sizing of aluminum oxide and silicon carbide abrasives for polishing uses, and for grinding wheel manufacture, has been reaffirmed without change for another year by the standing committee of the industry under the procedure of the Division of Simplified Practice of the National Bureau of Standards.

The producers of abrasive grains, following the adoption of a resolution which sets forth the desirability of identifying the grain made in accordance with the recommendation, have selected the following identification statement: "This abrasive has been made to comply with simplified practice recommendation R118–30, issued by the U. S. Department of Commerce."

Some Examples of the Benefits of Industrial Standardization[1]

The movement in the direction of the standardization of goods and materials is one of the most remarkable developments of recent years. Yet there still is, in some quarters, a very imperfect knowledge of what is meant by the term.

It may be worth while, therefore, if we devote a few minutes to a matter which is extremely important in these days of industrial distress and stagnation, and which, if properly handled, may do much to help trade onto the high road of prosperity again.

The real objects of standardization are the elimination of waste and the improvement in the efficiency of industry. Here are a few instances of how the principle works.

Twenty-five years ago the manufacture of cement was in a thoroughly disorganized condition. Every maker was a law unto himself. The buyer of cement knew what he was paying for the goods he purchased, but that was about all he did know. He had to take quality on trust.

The industry decided to organize itself, and one of the things it did was to prepare standard specifications for cement to which all the makers agreed to conform, and it was around these specifications that the reorganization of the industry took place. The great advantage to the consumer is that nowadays when he orders cement he can rely on getting an article to a certain specification which will always behave the same, no matter from where it is purchased.

The principle has always been adopted to some degree. For instance, the standard yard is 36 inches, and the standard gallon consists of four quarts, and the standard ton is 20 cwt, each of 112 pounds. With the coming of electricity, a standard unit of current was established. Then there was a standard of measurement for gas (the cubic foot), and now there is a standard of quality and quantity (the therm).

All the above-mentioned standards are fixed by law, but there are definite limits to the number of standards which the Government can impose, and the best bodies to establish industrial standards are the industries themselves.

There are two kinds of standards—those of size and those of quality. Let us consider them separately.

Certain goods are, and have been for a long time, standardized in size. Rain-water pipes are made in certain stock sizes. Suppose that, instead of the usual six feet lengths, one maker produced them 6 ft 3 in., another 6 ft, a third 5 ft 10 in., another 5 ft 6 in., what confusion and waste would result. Yet that is exactly what does occur in the case of hundreds of commodities. Each maker is a law unto himself, and the buyer is often at the mercy of chance.

The standardization of sizes does not actually limit our choice. On the contrary, it enlarges it. We can, for example, choose any make of electric lamp we like, confident that, when we get it home, it will fit the socket of every fitting we have.

But, although there is already a very considerable amount of standardization of sizes, the principle has not been nearly so extensively adopted with regard to quality.

If we are choosing the cloth for a suit of clothes, we can only judge the color and design. Unless we are experts, we have little to guide us as to quality. We are thrown back, therefore, on the advice of our tailor, and his advice may be unbiased and judicial, but it may not.

If there were a British Standard Specification for cloth, we should know that while there was a variety of choice in design of, say, A-Grade serge, the quality and essential content would always be the same, and that a B-Grade cloth would be a different article altogether.

Here is another instance of how the principle works, and how it helps industry. A British Standard has been set up for the sizes of the granite curbs needed for the margins of our arterial roads.

Now, owing to one cause and another, quarrying is an industry which is very apt to experience intermittent demands. If the stone has to be cut as and when required for all sorts of people it is likely to produce periods of alternate extreme activity and "little doing."

But, if the quarry owner knows that, when the demand does come, it will be for curbs of a certain size, he can, during the slack seasons, safely make for stock.

This tends to equalize employment for his staff. Moreover, the prevention of waste of time, material, and overhead charges enables the employer to compete better in the open market and secure more orders, thus tending to increase employment.

Now while, as we have seen, some standards,

[1] An abstract of an article by John E. Rickson, published in the April, 1931, issue of the *Plumbing Trade Journal*, London.

such as the Imperial pint and pound weight, are fixed by law, the Government is not the right body to fix general industrial standards, partly because of their number, but chiefly because such standards require reviewing and, possibly, modifying from time to time, in the light of new developments and invention.

Therefore, it would seem that the standardization of manufactures should be done by the various industries themselves, with such assistance as the Government from its own resources can give them.

As a matter of fact, this is the course which events have taken, and are taking in the matter.

The engineering and allied trades were the first to tackle this matter, and they have carried it further than any other body of manufacturers.

The result is that purchasers of engineering products can ask for British Standards, and can know exactly what quality of materials they are buying.

So long as 30 years ago the engineers of the country established the British Engineering Standards Association. They decided that it must be impartial and not under Government control, although the Government has to some extent supported it and cooperated with it.

Gradually, this Association has gained the confidence, not only of the industry that first instituted it, but of many other classes of manufacturers and consumers as well.

The scope of its operations has widened and now covers scores of industries. Indeed, B.E.S.A. has become almost a new word in the language, although not everyone yet knows what it stands for. . . .

The great value of the specifications is that they protect the purchaser of goods and assure him of a good average quality in the article he buys. The manufacturers are benefited in two ways. First, in the fact that all firms competing in the market for the same kind of business start from the same mark. Secondly, because there is a reduction in the number of varieties which they need to make.

There are also other benefits accruing from the system of standardization.

For instance, in preparing a specification for the construction of cranes, the committee brought into consideration not only matters of size and quality of metal, but that of safety.

Therefore, a consequence of the adoption of the standard specification has been a lessened liability for accidents. . . .

The Government has recently issued an instruction to all public authorities throughout the country to the effect that, in all State-aided schemes, goods which comply with the Standard Specification should be used.

One final point may be mentioned. Every virtue has its corresponding vice, and it would be possible, of course, to carry standardization too far, so that there would not be a reasonable variety of choice.

That is not likely to happen in this country. We are not all to be compelled to wear the same kind of clothes or to be limited to one type of motor car, which we must either buy or go without.

But, at present, we are making far more varieties in some classes of goods than there is any profitable demand for and, if the Standards Association continues its work on present lines, the results should make for an immense national economy and an increased efficiency in industry.

German Standard for Flexible Shafts Connections

A new German national standard (DIN VDE 2995), which deals with the connection between a flexible shaft and the driving electric motor, has just been published. The standard applies to flexible shafts with drive-shaft diameters ranging from 6 to 25 mm (about 1/4 inch to 1 inch), the diameters of the corresponding motor-shaft extensions ranging from 8 to 28 mm.

The connection between a flexible shaft and the driving electric motor involves, first, the connection between the driving shaft and the extension of the motor shaft, and second, the connection between the casing (also called "sheath" or "tubing"), which surrounds the driving shaft, and an extension of the motor housing. The dimensions governing the interchangeability between the corresponding parts, including standard fits between these parts, are given in the German standard.

In so far as the connection between the flexible driving shaft and the motor shaft extension is concerned, two different types, *A* and *B*, have been standardized. Type *A* is a threaded connection, while in type *B* the driving-shaft end is a part with a cylindrical bore which is slid over the cylindrical motor-shaft extension, and secured to the latter by means of a key and a screw.

As shown by a sketch given on the German standard sheet, the standard direction of rotation of the flexible shafts is clockwise when viewed from the driving electric motor.

The standard was developed under the procedure of the German national standarizing body (Deutscher Normenausschuss) and under the guidance of the German Association of Electrical Manufacturers, with the cooperation of the manufacturers of flexible shafts.

The standard is available for sale at 15 cents per copy or may be borrowed from ASA.

A Comparison of Various Methods Used in the Purchase of Raw Materials[1]

A discussion of the merits of purchase to trade name, to approved sample, to specification, and to guarantee

Were the running accounts of any large factory to be examined, one fact would become immediately evident—raw materials are nearly always the item of greatest magnitude. It is, therefore, clear that technical control should be exercised in purchasing. Buying to a price is obviously wrong, and carries in its wake any amount of difficulties and troubles. In the following short article a few notes are given on methods of purchasing. They are not exhaustive, but it is hoped that they present the fundamentals with sufficient clarity.

We may immediately list the methods as follows: (*1*) purchase to trade name; (*2*) to approved sample; (*3*) to specification; (*4*) to guarantee.

The purchase of raw materials to trade name is the oldest method, but still has many adherents. After experiencing uniform satisfaction from a particular supplier, one is naturally loath to change even when the price offered is favorable. Nevertheless, it is certain that no progressive company can afford to limit its efficiency by slavish adherence to any particular firms. Materials should always be bought on merit—the day of trade names is over.

A development of this method of purchasing is that of "approved suppliers." Technical and workshop tests are carried out on the products of a number of companies suggested, say, by the purchasing department. The results are carefully examined, and frequently the matter is discussed with the technical representatives of the suppliers themselves. Thus certain brands of material are chosen as fulfilling the requirements of certain jobs and are specified on the blue prints and layouts.

This method is a good one, but suffers from several disadvantages. In the first place, any go-ahead supplier will not rest content with particular grades of materials. All the time he is trying to improve them, and at the same time to effect cost reduction in his own factories. This almost certainly will result in slight changes of physical and chemical characteristics which may prove disastrous to some of his customers.

[1] Reprinted from the August 6, 1931, issue of *Machinery*, London.

Purchase to approved sample is a very favored method adopted by smaller companies and those whose product is apt to be of a changing nature. The procedure of such a purchase is as follows:

First, the technical departments prepare a rough statement of their requirements, which is handed to the purchasing branch, who circulate it to firms in their knowledge reputable. Samples eventually arrive, together with quotations. The former are passed to the technical or production departments, who examine them and try them out under working conditions. If the samples are satisfactory, then a memo to the purchasing department authorizes them to proceed with the placing of orders. If not, the defects of the samples are discussed with the suppliers in question until a compromise is arrived at.

Before bulk delivery is made, further samples are usually required. These should be actual production components, or, in other words, as run off the machines. These proving satisfactory, the remainder of the order is carried through in the ordinary way, a thoroughly good specimen from the first delivery being retained as a criterion of quality.

This method is usually found to be quite satisfactory, especially where the purchasing department has good firms on its list. It is, however, dangerous when new suppliers have to be approached at a moment's notice. Frequently trouble then arises through the fact that bulk deliveries do not coincide with samples submitted in the first place.

Purchase to specification is undoubtedly the best method, and is adopted by all the large companies. The preparation of specifications is by no means an easy matter, and calls for great experience and at the same time no mean technical ability. It is not a case of putting on paper exactly what one requires. This is only too easy of accomplishment. The specification often has to be a compromise between what is most desirable and what can be purchased at a reasonable figure and from a sufficiently large range of suppliers. There are numerous forms of specification, but a good one contains the following clauses:

1. General clause. This usually takes the form of a statement to the effect that the clauses of the specification are to be accepted as binding, and any material not fulfilling the properties set down will be rejected.

2. General properties. This takes the form of a plain statement of what is required. For instance, if we were dealing with free-cutting brass rod, the general clause would state that ordinary commercial extruded free-cutting brass rod is required under this specification.

3. The physical properties. Under this clause tensile strengths, elongations, hardness, etc., would be included.

4. Special properties. These vary according to the nature of the material. Thus, for electrical insulation the dielectric strength lost due to protracted heating and water absorption would be mentioned, as also might the corrosive properties as exemplified by reaction test.

5. Dimensions. Under this clause the physical tolerances on the diameters of the material are specified. Incidentally it might be mentioned that this is one of the most difficult to prepare, since manufacturers do not always agree with the published work of the British Engineering Standards Association. In the preparation of such data it is of the utmost importance that the raw materials technical man should consult freely with the inspection department on their previous experiences. A further item also calculated under this head would be that of the lengths, weights, etc., which would be accepted. In a factory where machine room is limited it is often out of the question to accept bars above a certain length, as these would have to be cropped short prior to machining, thus necessitating an extra operation and probably modifying the estimated cost figure.

6. Packing. The scope of this clause is self-evident, and varies according to the nature of the material and the distance from the suppliers.

Buying to guarantee is a method sometimes adopted. Put briefly, the idea is that a company tells the supplier exactly what is required of the finished job. The latter then guarantees to supply a product at a particular price, which will fulfill the requirements. This method serves well enough, and it is certainly simple of application, since it involves no technical expense in the preparation of specifications and the like. However, it is easily capable of abuse, and, in the writer's opinion, small firms who have agreed to a guarantee have sometimes wished they had declined the order.

The real objection to the method lies in the fact that the quality of the finished article depends on the grade of material used, which constitutes the least of the variable factors of manufacture. The others include all the manufacturing operations with their chances of error. Thus, the supplier may easily have to bear the onus of faults in other directions for which he is totally free from blame.

Before concluding, one further remark should be made with reference to purchase by trade name. In certain instances this is undoubtedly the safest policy to follow. Take the case of case-hardening steels. There are many scores of brands on the market, but in the writer's opinion only four or five are of the very first quality. It is difficult in a specification to lay down tests which will definitely establish the quality of a case-hardening steel without actually putting through a small sample, breaking, and examining the case produced in the metallurgical department. Thus, buying to trade name from a thoroughly reputable firm in this case is of advantage. Several others will occur to the reader.

A.S.T.M. Report on Petroleum Products

The American Society for Testing Materials has just published its *Report of Committee D-2 on Petroleum Products and Lubricants and Methods of Test Relating to Petroleum Products*. The 267-page book contains, in addition to the report of the Committee on Petroleum Products and Lubricants (D-2), 33 standard methods of test and 14 tentative test methods for products in the petroleum field. These include the 23 standards for petroleum products and lubricants (Z11), which have been approved by the American Standards Association as American Standard and American Tentative Standard, as well as the American Tentative Standard for Method of Test for Flash Point of Volatile Flammable Liquids (K8-1923), and three American Standards for bituminous materials.

Standard methods of test are included for the determination of bitumen; burning quality of kerosene oils and mineral seal oils; carbon residue of petroleum products; cloud and pour points; color of lubricating oils, of petrolatum, and of refined petroleum oil. Tests for the dilution of crankcase oils, distillation of crude petroleum, gasoline, naphtha, etc., flash points, gravity by means of the hydrometer, and the analysis of grease are also given.

Copies of the book may be obtained from the ASA office or from the A.S.T.M. office. The price is $1.25 per copy. The American Standards Association will be glad to lend copies to Sustaining-Members interested in reviewing this book.

Investigation of Problem of Gum Formation in Motor Fuels

The problem of gum formation in gasoline, to which little attention was paid in the early days of petroleum refining, has recently become of major importance to the petroleum and automotive industries. Changes in design of motors and in refinery practice through the extension of high temperature cracking of fuel oils have brought the gum problem forcibly into the limelight. Lack of information as to just what the gum might be and also the mechanics of gum formation, together with unstandardized methods of determining gum in motor fuels, have delayed the campaign to reduce the harmful effect of gum in motor fuels.

A recent article in the *Oil and Gas Journal*, which is excerpted below, is of interest in this connection:

"A committee of the American Society for Testing Materials has been appointed to study the problem of gum in gasoline. In a preliminary report it has pointed out that perhaps the most important phase of the subject is that of gum stability, as indicative of the length of time which gasoline can be stored before it develops the maximum tolerable amount of gum. Much work remains to be done, however, before a satisfactory specification can be set up which will indicate whether a gasoline is sufficiently stable to be marketed or stored with safety or whether it must be reprocessed to increase its stability. The great advance which has been made in cracking operations emphasizes the necessity for arriving at official testing methods and evolving authoritative pronouncements backed by results of actual tests of gum-containing gasolines in automobile engines under conditions met by the consumer.

"In the investigation now being made by a subcommittee of the American Society for Testing Materials, part of the blame is being placed at the door of the automobile engine designer. This subcommittee has found quite early in its work that different automobile engines vary considerably in their degree of susceptibility to a 'gum trouble.' In tracing possible trouble factors in engine design apparently no significance attaches to the construction and location of the fuel system from the reservoir to and including the carburetor. From the carburetor outlet to the combustion chamber, however, especially in connection with the design of the manifold system and the location of the valves, variations in design among the different engines produce widely differing results in respect to trouble from gum accumulation.

"Extensive tests have also been made by the National Benzole Association of England on the effect of gum formation in benzol and benzol blends. Their results are in full accord with the work done in this country on cracked gasoline and they conclude that 'the deposits found in the induction systems of internal combustion engines are due chiefly to the non-volatile resin formed during storage and already present in the motor spirits before use.' "

Report of Committee on Diesel Fuel Oil Specifications

In a recent issue of *Diesel Power*, a report of the A.S.M.E. Special Research Committee on Diesel Fuel Oil Specifications was presented by W. H. Butler, secretary of the committee. This committee also functions as a subcommittee of the Sectional Committee on Specifications for Fuel Oils (K19), sponsored by the A.S.T.M. under the procedure of ASA.

"Mr. Butler's report," comments the editor of *Diesel Power*, "is a clear and concise statement of the responsibilities with which the Special Research Committee on Diesel Fuel Oils Specifications is faced and the material limitations under which it is compelled to function. One of the problems requiring solution is that of studying various oils which have proved unsatisfactory in the field even though their physical properties seem to designate them as being highly satisfactory fuels for Diesel engine operation. The effect of viscosity and conradson carbon, as well as the subjects of spray dispersion, combustion, etc., especially in high-speed engines, are other phases of fuel oil utilization requiring further study.

"By a coordination of effort on the part of the various interested committees a research personnel has been organized and so integrated as to prevent duplication of effort. But in order to accomplish anything of value it is necessary that the

work of these various committees and subcommittees be properly and adequately supported by the industry, the membership of which will profit in proportion as the industry as a whole and in its parts furnishes this support. It is an obligation that rests, not on a few leaders, but rather is it a responsibility of the entire Diesel industry. Support given now when there are both time and opportunity to conduct this very necessary research work will pay handsome dividends in the future and will be a constructive and visible means of advancing the interests and welfare of the membership of the industry."

Inter-Society Color Council Holds Organization Meeting

The first meeting of the Inter-Society Color Council, composed of delegates from national societies and associations interested in the standardization, description, and specification of color, which was organized as the result of a special conference on February 26 under the auspices of the Optical Society of America and the American Physical Society, was held at the Museum of Science and Industry, New York, on September 21. At the meeting, E. N. Gathercoal, Professor of Pharmacognosy, University of Illinois, Chicago, was elected chairman of the Council; L. A. Jones, president of the Optical Society of America, Eastman Kodak Company, Rochester, was elected vice-chairman; M. Rea Paul, consulting colorist, National Lead Company, Brooklyn, representing the American Society for Testing Materials, secretary; and A. E. O. Munsell, Munsell Research Laboratory, Baltimore, representing the Optical Society of America, was elected to the position of treasurer of the Council.

As the first step toward forming a permanent organization, a committee on constitution and by-laws was appointed and it was recommended that the Executive Committee of the Council consider the appointment of the following three committees:

Committee on Membership

Committee on Color Nomenclature

Committee on Measurement and Specification of Color

The organizations represented at the meeting were: American Association of Textile Colorists; American Chemical Society; American Oil Chemists' Society; American Pharmaceutical Association; American Society for Testing Materials; Illuminating Engineering Society; International Society of Master Painters and Decorators, Inc.; National Academy of Design; New York Museum of Science and Industry; Optical Society of America; Technical Association of the Pulp and Paper Industry; Textile Color Card Association of the U. S., Inc.; and U. S. Pharmacopoeia.

The next meeting of the Council will be held prior to January 1, 1932.

British Standards Increase Electric Light Output

The effect of standards on quality of production is noted in the following quotation from the *Electrical Review*, London, which points out the increased light output of lamps due to the use of specifications of the British Engineering Standards Association. In commenting on the use of the B.E.S.A. specifications, the article says:

"Lamp quality should also be kept before customers, for there has been an increased light output throughout the life of the lamp of not less than 13 per cent. This means that the light obtained from a 60-watt lamp over a thousand-hour life at 3d. (6 cents) per kwh costs today:

	s.	*d.*
60 kwh at 3d.	15	0
Cost of lamp	1	10
Total price	16	10
	(about $4.10)	

"On this basis lamps made to the latest B.E.S.A. specifications could cost 1s. 11d. more than lamps made to the previous specifications without representing any actual loss to the user. The average test lives of all the more popular lamps manufactured by E.L.M.A. (Electric Light Manufacturers Association) members exceed 1500 hours."

The Use of Standardization in Buying by Consumers

The following article by Jessie V. Coles of the University of Missouri is reprinted from the October issue of the Journal of Home Economics:

The description of characteristics of goods in terms of standards is called "standardization." Industry now uses standards to specify characteristics of goods to be produced. Standards

may also be used to describe goods for the benefit of consumers to aid them in buying.

Standard specifications may be stated in terms of standard units of measurement or standards may be set up creating grades. One standard creates two grades of goods, those falling below and those above the standard. Several standards may be set up with a series of grades resulting. A theoretical maximum standard may also be set up and goods may be rated according to this maximum. One quality or performance or several may be described in a single set of specifications.

The adoption and use of standards which provide for the identification and comparison of characteristics of goods will permit the use of intelligence and judgment by consumers in buying to a greater extent than is possible at present. Standardization will provide a means of securing the best for the purpose with a minimum expenditure of time, energy, and money.

Standardization is a complex process with many difficulties involved. The determination of the need for a standard and the ability to recognize and isolate pertinent characteristics is necessary. Exact procedures for identifying and measuring these characteristics must be developed. Terms must be defined exactly, and decisions must be made regarding the use of standard units of measurement or grades or ratings. Exact magnitudes for the characteristics which set the limits of the grades or which constitute the bases for ratings must be chosen.

Agencies for inspecting and certifying goods must be established. Goods must be labeled and advertised in terms of standards, and consumers must be educated to use standards when they are available. A definite program to promote the development of standards through creating consumer demand for them is one of the first essential steps in the standardization movement which must be undertaken by home economists.

Specifications for Materials for Road Surfaces

The Asphalt Institute has recently issued seven simplified specifications covering bituminous materials used in the treatment, construction, and maintenance of various types of road surfaces. These specifications have been issued in tentative form. It is the hope of the Institute that this move will decrease the unnecessarily large number of asphalts that are now called for in specifications issued by various highway departments.

These new specifications are the result of cooperative efforts by the Asphalt Institute, U. S. Bureau of Public Roads, and various state highway departments. It has been realized that specifications used in the past have shown extreme variation in form and detail such as to require production of several different asphalts to be used for similar and, in some cases, identical purposes.

As part of these cooperative investigations, a simplified scheme of analysis consisting of a limited number of tests is being developed for the purpose of accumulating uniform test data by asphalt producers and road builders during the present season. The tests proposed cover flash point, consistency, distillation, tests on distillation residues, and naphtha solubility of the asphaltic substances. The methods proposed for these tests follow previous standard tests with but slight modifications.

The Inquiry Issues Manual on Business Conferences

Preliminary work on a project to cover a systematic study of conferences in action has resulted in a *Research Manual for the Study of Business Conferences*, prepared by Glenn A. Bowers and Leona Powell, and published by The Inquiry.[1]

The *Manual* includes a series of meeting record forms, which are intended to serve as a basis for the accumulation of information and experience for the comprehensive two-year study of the general subject now being carried on by The Inquiry.

The present study is essentially a task of describing what goes on in business and industrial conferences, identifying causes of conference successes and failures, and following action through to final results.

While systematic techniques are to be studied, according to the *Manual*, "the main emphasis in the present study is placed on the inner workings of conferences and committees rather than on routine practices and external factors. The crucial problem is the construction of forms for recording the unseen and intangible determinants of conference action . . . this has required much experimentation in arriving at the schedules presented. Their use in the study should aid in their more effective formulation for future studies."

Copies of the *Manual* may be obtained from The Inquiry, 129 East 52 Street, New York, N. Y., for 50 cents each.

[1] For a discussion of the organization of The Inquiry see page 19 of the June, 1931, issue of the ASA Bulletin.

Grading Considered Vital to Tobacco Marketing

The effect of the introduction of standard grades upon prices at which commodities are sold, particularly by agricultural producers, has been frequently reported in various investigations by the Federal Government.

A recent instance is found in a report in *The Official Record* of the Department of Agriculture for December 25, 1930, on the results of a survey of Virginia and North Carolina markets by the Bureau of Agricultural Economics. Over a period of several weeks, according to the report, Government-graded tobacco returned to growers on an average of $1.36 more per hundred pounds than ungraded tobacco of identical quality. As the Government grading costs but ten cents per hundred pounds, it is evident that pricing on the basis of the standard grades produced an increment in favor of the graded tobacco amounting to nearly 14 times the cost of the service. The Federal Government grading service includes inspection of tobacco by Government experts before it is auctioned, labeling each lot according to a system of standard grades, announcing the grade to buyers prior to bidding, and posting current market prices by grades.

The subject has also been under investigation by the Federal Trade Commission, the Chief Examiner of which recently reported on the question of economic difficulties experienced by the tobacco growers. He found that the lack of systematic grading in the tobacco business is largely responsible for the financial troubles of the producer.

He recommends reformation of the warehouse organization methods so that tobacco can be sold according to its proper grade and quality, and a system of cooperation between grower and manufacturer so that the grower can come to understand the manufacturer's needs and tend to govern the quality of tobacco produced. The present unsatisfactory situation with respect to the estimation of grades and the evident lack of standards in the industry is instanced by the fact that transactions are conducted at the rate of from 200 piles of tobacco leaves to as high as 350 or 400 piles an hour, the number of piles per hour usually averaging about 300.

"The buyer is required to inspect, grade, and buy tobacco at the rate of about one transaction every ten seconds," the report states, "and as there may be from 10 to 20 buyers in the line it is manifestly impossible for each to inspect a pile of tobacco. Often the competitive feature associated with a system of selling such as this is lacking. The result is a lack of stability in prices, there being a wide range in prices for different piles of tobacco of apparently similar quality.

"The tobacco buyer bases his judgment largely on uniform length, quality, and color of tobacco. Where the farmer has not sorted his tobacco carefully there is usually a mixture of grades which results in bringing high-priced and low-priced tobacco together in a pile and the price paid for a pile of tobacco will often be based on the lower grades contained in the pile, with the result that the better grades are sold for a loss.

"Large tobacco companies have their own grading systems with which the grower is not and cannot be familiar. This fact puts the present warehousing methods almost entirely in favor of the manufacturer." F.J.S.

Standardization of Agricultural Machinery in Russia

Among the important developments which mark the organization of agriculture and industry in Russia are: first, the mechanization of agriculture, which has been undertaken with astonishing energy; and, second, the effort to develop manufacturing plants and organizations capable of supplying the enormous home market with machinery manufactured in Soviet Russia. Related in the most direct way to both of these developments is the standardization of agricultural machinery and tools which is proceeding in Russia with great energy and is supported by a considerable expenditure of funds. This program is to be accomplished by far-reaching standardization applied to complete machines and implements. It became apparent early in the program, however, that these comprehensive plans could not be completed in the short time originally allowed. The development of standards for horse-drawn plows, horse-drawn seeding-machines, winnowing machines, and sorting machines was started in 1927, but completion of the standards is not yet in sight.

In an article by N. Fedotoff, the director of the Russian standardization work on agricultural implements, in *Agricultural Machinery*, Moscow, 1930, Numbers 1–2, the practicability of such standardization, judged from the present point of view, is questioned. The author proposes separation of standardization work, as such, from scientific research work. Complete standardization of agricultural implements in all details is not considered desirable as leading to lack of flexibility in design and manufacture. It is rather recommended that the implements be standardized as to type; *i.e.*, that only their general form and main dimen-

sions be laid down. In addition to this, it has been found advantageous to standardize both dimensions and quality of the most essential component parts with a view to securing interchangeability.—*Translated from an article in the January, 1931, issue of Sparwirtschaft, a magazine dealing with economies in industry, published in Vienna, Austria.*

Specifications Bring Savings on County School Purchases

Savings estimated at from one-third to one-half in the purchase of $25,000 worth of school supplies were made in the County of San Joaquin, California, by means of centralized purchasing based upon standard specifications, according to Fred. L. Mispley, State Purchasing Agent of California, writing in the *Purchasing Agent* for September, 1931. A law adopted in California in 1927 provided that the county superintendent of schools should purchase standard supplies and equipment for school districts under his jurisdiction and that in counties having county purchasing agents these purchases might be delegated to the county agent.

The first act of the county purchasing agent of San Joaquin when he was delegated to act for the superintendent of schools was to prepare a book of standard specifications. Mr. Mispley writes:

"This was done after consultation with the school authorities to find out what standards or qualities were required. Then the manufacturers and dealers were consulted as to the specifications which would properly cover the desired quality and invite competitive bidding. The deliveries are made direct by the vendor, as this county does not operate a central store department.

"The total purchases for 1929–1930 for standard school supplies in this county were almost $25,000. The operating cost of purchasing was $1500, or approximately six per cent. The operating cost of the central county purchasing department combined with the school purchasing operation was two per cent. The estimated saving over the previous method of decentralized buying was from one-third to one-half. Other counties in California show the same results.

"Compare this situation with the conditions prevailing in most of the school districts outside of incorporated cities before the enactment of this law. Salesmen from school supply houses canvassed the teachers, clerks, and trustees of school boards. They took all the traffic would bear. One district would pay as much as double the price charged in another district. I have seen schedules of supplies sent out by some of the districts wherein were grouped all kinds of supplies, such as stationery, hardware, paints, and janitorial supplies. The bidder was compelled to bid on the entire list or his bid would not be considered. Can you imagine a purchasing agent requesting hardware or paint bids from a stationery dealer? Can you imagine the district getting its money's worth under such a system?"

New Committee Members

G. O. Sanford, assistant director of reclamation economics, Bureau of Reclamation, Washington, D. C., succeeds C. A. Bissell, formerly representing the U. S. Bureau of Reclamation, on the Sectional Committee on Specifications for Drain Tile (A6-1925).

A. C. Johnson, Vacuum Oil Company, 61 Broadway, New York, N. Y., is representative of the American Society for Testing Materials on the Sectional Committee on Methods of Testing Petroleum Products and Lubricants (Z11).

Hydraulic Society Standards

A book of standards of the Hydraulic Society covering rotary and centrifugal pumps, reciprocating displacement parts, and deep well pumps, and including definitions, a standard classification for pumps, and tables and curves showing friction of oil in pipe lines, has just been issued by the Society. Copies of this book, which is the sixth edition, may be purchased from the Hydraulic Society, 90 West Street, New York, N. Y., for $1.00 each, or borrowed for review from the ASA office.

New A.I.M.E. Secretary

Dr. H. Foster Bain, secretary of the American Institute of Mining and Metallurgical Engineers since July, 1925, has resigned to become affiliated with the Copper and Brass Research Association, New York. Dr. Bain is succeeded by A. B. Parsons, assistant secretary for the past two years. Representatives of the Institute are active in several projects under the procedure of the American Standards Association.

ASA PROJECTS

A Review of Mining Projects under ASA Procedure

The second of a series of reviews of standardization projects under the procedure of the American Standards Association

The status of all mining projects under ASA procedure is summarized in the following review. The data presented are taken from the files of the American Standards Association and are corrected to December 1, 1931, bringing up-to-date the review of mining projects published in the January, 1931, issue of the ASA BULLETIN. The personnel of the sectional committees handling the projects may be found by reference to the project section of the 1931 American Standards Association Yearbook (pages 66–69).

M2-1926—Safety Rules for Installing and Using Electrical Equipment in Coal Mines

Sponsor—American Mining Congress, U. S. Bureau of Mines.

Chairman—O. P. Hood, Bureau of Mines, Washington, D. C.

Safety Rules for the Installation and Use of Electrical Equipment in Coal Mines, based upon earlier safety recommendations of the Bureau of Mines, were prepared by a sectional committee under the joint sponsorship of the U. S. Bureau of Mines and the American Mining Congress and approved by ASA as American Standard on October 8, 1926. Recent study by the sectional committee indicated no necessity for a revision in the near future.

In the preparation of these safety measures the extra hazard of mining operations caused emphasis to be placed upon the proper location of apparatus and conductors, and also upon the complete control of electric current and electrical equipment through protection devices. Both general and specific points concerning electrical equipment in mine structures on the surface, as well as underground, have been covered. Particular attention has been given to the prevention of fires and accidents.

M5—Methods for Screen Testing of Ores

Proprietary Sponsor—American Institute of Mining and Metallurgical Engineers.

Chairman—Galen H. Clevenger, chairman, Milling Committee, American Institute of Mining and Metallurgical Engineers, Boston, Massachusetts.

This project, initiated as a result of a research study by the Milling Committee of the American Institute of Mining and Metallurgical Engineers, reached the draft stage early in 1930. Discussion of this draft resulted in the appointment of a subcommittee to arrange the contents in final form prior to its submittal to letter ballot of the Milling Committee of the American Institute of Mining and Metallurgical Engineers. The chairman has recently advised this office of the completion of the letter ballot. It is expected that the standard will shortly be presented to the sponsor for endorsement and transmission to ASA.

M6-1931—Drainage of Coal Mines

Sponsor—American Mining Congress.

Chairman—W. E. Housman, research engineer, H. C. Frick Coke Company, Scottdale, Pennsylvania.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Standardization of practice in the use of field pumps, permanent pumps, piping for pumps, operation of pumps, storage of mine water, natural drainage, unwatering of abandoned workings, and recommendations of metals and alloys with acid-resisting qualities.

Revision of this standard, originally developed under the auspices of the American Mining Congress and approved by ASA in 1927, required the preparation of six drafts by the sectional committee. The fourth draft, after endorsement by the sectional committee and the sponsor, was transmitted to ASA. At the request of the National Electrical Manufacturers Association, formal action was deferred pending consideration of certain changes in the technical content of the standard. As a result of subsequent conferences, the sixth draft was prepared and unanimously approved by the sectional committee. Following submittal by the American Mining Congress, the revised standard was approved on October 1, 1931.

This standard is now in the hands of the printer and will shortly be issued by ASA in standard form.

M7a-1927—Coal Mine Tracks, Signals and Switches

Sponsor—American Mining Congress.

Chairman—F. C. Hohn, Hazelton, Pa.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Standardization of coal mine tracks, signals, switches, wood and metal ties and other items of track construction, together with recommendations of efficient installation and maintenance practices.

This standard, approved in 1927, has been undergoing revision by a sectional committee sponsored by the American Mining Congress since May, 1930. At that time a meeting of the reorganized committee outlined a program involving detailed work by several subcommittees.

Reports of several meetings of the Subcommittee on Frogs, Turnouts, and Switches (chairman, R. L. Ireland) have indicated satisfactory progress. At a meeting on May 14, 1931, plans for standardizing and simplifying frogs and turnouts for coal mine tracks for both gathering and main-line haulage purposes were discussed. Specifications of certain details have been prepared.

Wood mine-ties have been considered by another subcommittee (chairman, R. D. Tonkin). Reports of this subcommittee indicate that some study has been given to specifications for mine-ties in O3-1926 (Specifications for Cross-Ties and Switch-Ties). It is possible that additional specifications for shorter ties, such as are used in the majority of mines, may have to be developed.

M10-1928—Miscellaneous Outside Coal Handling Equipment

Sponsor—American Mining Congress.

Chairman—W. R. Roberts, Roberts & Schaefer Company, Wrigley Building, Chicago, Illinois.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Standard system of signals for hoisting and lowering; requirements for devices used in hauling men on inclines; requirements for devices used in hoisting and lowering men in shafts; practice in safety methods around the tipple; fire protection; and shafting pedestals and bearings.

This standard was approved as American Tentative Standard on July 31, 1928.

Although no revisions have been found necessary, suggestions have been made that this standard should be broken up into about three documents whenever revision is required.

M11-1927—Wire Rope for Mines

Sponsor—American Mining Congress.

Chairman—Henry Mace Payne, consulting engineer, American Mining Congress, Washington, D. C.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

This standard was approved as American Tentative Standard on February 24, 1927. It has had a fairly wide distribution. No requests for revision have been received.

M12-1928—Construction and Maintenance of Ladders and Stairs for Mines

Sponsor—American Mining Congress.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

This code was approved as American Tentative Standard on May 9, 1928. In its preparation care was taken to correlate its provisions with those contained in the Safety Code for the Construction, Care, and Use of Ladders (A14-1923). As the latter standard is now being revised, the question of a revision of M12-1928 will come up in due course.

M13-1925—Rock Dusting of Coal Mines

Sponsor—American Institute of Mining and Metallurgical Engineers.

Chairman—Howard N. Eavenson, Union Trust Building, Pittsburgh, Pennsylvania.

Scope—Materials and their preparation for rock dusting mines; methods of applying the dust; methods of inspection and renewal.

Some years ago, as a result of the intense feeling aroused by coal mine disasters, efforts to minimize such occurrences with their attendant loss of life and damage to property led engineers to investigate rock dusting for the interior surfaces of the workings of bituminous coal mines. Indications of the value of this safety measure were so promising that a project to develop a standard was undertaken; this was completed and the standard approved on December 30, 1925.

The promotion of rock dusting as a safety measure has been going on continuously. Inspectors and supervisory officials of the several coal-mining states, engineers of the U. S. Bureau of Mines, the mining companies themselves, and also insurance regulations have all cooperated to extend its use. The value of these

measures has been demonstrated on several occasions in recent years and dust or gas explosions, which in a non-rock-dusted mine might have been major disasters, were confined to small sections of the underground operations.

M14-1930—Use of Explosives in Bituminous Coal Mines

Sponsor—Mine Inspectors' Institute of America.

Chairman—J. W. Paul, chief mining engineer, Bureau of Mines, Pittsburgh, Pennsylvania.

Scope—Suitability of types of explosives and appliances for use in bituminous coal mines; handling and storing explosives on surface; transportation, handling and storage underground; methods and precautions for charging and firing, including inspection.

The proper handling of explosives in bituminous coal mines is covered by this standard, approved as American Recommended Practice on April 2, 1930.

Its publication was accompanied by the coincident appearance of American Recommended Practice for Fire Fighting Equipment in Metal Mines (M17-1930). Both standards have had wide distribution. Copies have been distributed through the U. S. Bureau of Mines and by state mining officials, not only to the staffs of these organizations but also to mining companies throughout the United States and Canada. Requests for copies have also been received from foreign countries.

The value to be obtained from the adoption of the provisions of these codes seems to be well recognized.

M15-1931—Safety Code for Coal Mine Transportation

Sponsor—American Mining Congress.

Chairman—Fred Norman, chief engineer, Allegheny River Mining Company, Kittanning, Pennsylvania.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Safety provisions for transportation, underground, above-ground at the mine, and haulage on slope or incline into the mine; motor haulage, animal haulage, mechanical haulage, haulage by hand; signals and provisions for safety in construction, tracks, cars, clearances, and loads; and operating rules.

The development of a safety code for coal-mine transportation for both underground and surface operations has been completed under the leadership of the American Mining Congress. In the course of its work six complete drafts of the standard were prepared. After unanimous approval by the sectional committee and endorsement by the sponsor, the sixth draft was approved by ASA as American Recommended Practice on June 24, 1931, and was published by ASA in standard form in September.

In the standard as approved, safety features and recommendations regarding details of construction are given. Transportation in the mine and in the yards on the surface is covered together with haulage on inclines or slopes leading to mine workings. Signal systems, safety provisions, and operating rules are included. Replies to the preliminary distribution indicate a favorable reception by the mining industry; further adoption of its provisions is to be expected.

M17-1930—Fire Fighting Equipment in Metal Mines

Sponsors—American Mining Congress, National Fire Protection Association.

Chairman—William Conibear, safety inspector, Cleveland Cliffs Iron Company, Ishpeming, Michigan.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Fire preventive measures and minimum facilities and equipment required for fire fighting in metal mines; including water supply, hose, fire extinguishers, sprinkling systems, availability and care of oxygen rescue apparatus, fire signals, regulations governing fire doors, fans, control of ventilating during mine fires.

This standard was approved as American Recommended Practice on October 14, 1930. No requests for revision have been received. Comments regarding its distribution are given above under M14.

M18-1928—Underground Transportation in Metal Mines

Sponsor—American Mining Congress.

Chairman—George H. Rupp, general manager, Mining Department, Colorado Fuel and Iron Company, Pueblo, Colorado.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Standardization of the elements of underground transportation in metal mines for both hand tramming and motor haulage; including gage and grade of track; weight of rail; capacity and type of car; dimensions of drift.

The standard developed from this project was approved on May 26, 1928. The sponsor—the American Mining Congress—has already drawn up plans for expanding this standard. It is proposed to divide the project and treat the various phases of underground transportation as individual problems from which separate standards may be developed. Reorganization of the sectional committee has not been completed.

M19-1928—Mechanical Loading Underground in Metal Mines

Sponsor—American Mining Congress.

Chairman—Lucien Eaton, New York.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—General requirements for mechanical shovelers and scrapers for use in metal mines, with recommended practices for their operation.

The present document, approved by ASA on April 2, 1928, was intended to indicate the general lines that standardization might follow to be more effective for mechanical loading in metal mines. Provisions giving general requirements for shoveling and scraping machines, together with recommendations for their operation, have been included. Revision and expansion of this standard has been proposed.

M20—Classification of Coals

Sponsor—American Society for Testing Materials.

Chairman—A. C. Fieldner, chief engineer, Experiments Stations Division, U. S. Bureau of Mines, Washington, D. C.

Secretary—C. B. Huntress, executive secretary, National Coal Association, Southern Building, Washington, D. C.

Scope—The classification of all coals from anthracite to lignite, to be based upon such chemical and physical characteristics as will make the plan most readily adaptable to industrial and commercial use on a national scale.

Emphasis upon the development of a useful and practical system, or systems, for the classification of coal has been the aim of all associated with this project from its inception in 1927. Undertaken at the request of the Coal Mining Institute of America, this subject is being studied, with the American Society for Testing Materials as sponsor, by a representative sectional committee under three divisions: scientific classification, use classification, and marketing practice. Technical committees to correlate data and direct research campaigns have been appointed for each of these divisions. To assist the technical committees several subcommittees have been actively engaged upon investigations to determine the adaptability of different coals to various uses, to study the occurrence of North American coals and their composition and origin, and to consider suggested systems of classification.

Cooperation with the Associate Committee on Coal Classification of the National Research Council of Canada has been closely maintained since the inception of this project, thus avoiding duplication in the distribution of research problems. Meetings of the Canadian and American groups have been attended by representatives of the other committee. Through Chairman O. C. Merrill of the American Committee of the World Power Conference, contact with the foreign countries has been established.

Since its organization the committee and its associated technical and subcommittees have held frequent meetings. One subcommittee (Present and Proposed Systems of Classification) has completed a comprehensive study of all existing systems for classifying coal and developed a scheme for comparing the position of various coals in these systems by means of the Rose Multibasic Coal Chart. Detailed reports and papers have been published on the nature, mode, and occurrence of coals; classification systems; physical and chemical characteristics; coal for gas and coke production; marketing practices in different sections of the country; railroad fuel; coal for metallurgical purposes; etc. A symposium held at the annual Winter Meeting of the American Institute of Mining and Metallurgical Engineers in 1930 proved so successful that a similar symposium for the presentation and discussion of recent work is planned for the 1932 meeting of the A.I.M.E. A report of activities of the sectional committee for the year ending June, 1931, may be found in the ASA BULLETIN for June, 1931.

The latest meeting of the sectional committee and of the Technical Committee on Scientific Classification, including subcommittees of the latter, was held in Pittsburgh on November 19, 1931, in conjunction with sessions of the Third International Conference on Bituminous Coal. The Technical Committee on Use Classification reported that several investigations covering coal for different purposes were under way. Papers have been completed for coal used in the cement, ceramics, and metallurgical industries. Progress was reported on studies of coal for domestic fuels. The importance of data correlating stokers with types of coals suitable to different stokers was emphasized. For the Technical Committee on Scientific Classification an outline of the research already under way as well as of that proposed was presented. A progress report covering studies of graphical presentations of data which may serve as a basis of classification of coals was given. An investigation of certain properties of coals in Alberta, Canada, was summarized. Several British and Canadian technologists, delegates to the Coal Conference, were present as guests and together with the members of the sectional committee participated in the general discussion that followed.

M21—Specifications for Coal Mine Cars

Sponsor—American Mining Congress.

Scope—Design and materials of construction for some of the details of coal mine cars.

Originally a part of the older project of recommended practice for coal mine transportation, studies of the possibilities of standardization of coal-mine cars were decided upon in 1929. It was then realized that standardization in this field could not be accomplished without a campaign of several years duration. However, it was believed that the large savings that should result to both the car manufacturer and the mine operator amply justified the initiation of the project.

Under the auspices of the American Mining Congress several informal discussions of this subject have been held. As a result, the original idea—to standardize coal mine cars—has been modified and it is now proposed to develop specifications covering certain details of mine cars, such as couplers, drawbars, wheels, bearings, bumpers, etc. Cooperation in this work has been promised by coal-mining organizations and also by manufacturers of cars and parts. It is believed that this problem is especially urgent in view of the growth of mechanization of coal-mining operations in the United States and the resulting demands for larger or different types of cars.

M22—Mine Timbering

Sponsor—American Mining Congress.

Chairman—Reamy Joyce, vice-president, Joyce-Watkins Company, Chicago, Ill.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Grades, names, and sizes of coal mine timbers; preservative treatment of coal and metal mine timbers, grades, names, and sizes of metal mine timbers; practice in the storage of mine timbers; practice in the use of timbers in coal mines; practice in the use of timbers in metal mines.

The project on mine timbering, including both specifications and details of mine practice, was initiated under the sponsorship of the American Mining Congress in 1930. Although difficulties have been encountered in the organization of the committee, a program outlining the project has been prepared.

A subcommittee, appointed in May, 1930, prepared a draft for "Preservative Treatment of Mine Timbers," and some months ago this draft was circulated for comment and criticism. However, action has been held up pending the complete organization of the sectional committee. In May, 1931, Reamy Joyce, a specialist in timber for mining and industrial purposes and in wood-preservation methods, and vice-president of the Joyce-Watkins Company of Chicago, Illinois, was appointed as chairman.

Mr. Joyce and officials of the National Standardization Division of the American Mining Congress have revised the earlier outlines and it is now proposed to handle the problem of mine timbering from a geographical as well as a subject standpoint. The organization of subcommittees to develop specifications and mine-timbering practice is now under way. Reports of these subcommittees will serve as a basis for the formulation of standards.

M24—Safety Rules for Installing and Using Electrical Equipment in Metal Mines

Sponsor—American Mining Congress.

Chairman—F. L. Stone, General Electric Company, Schenectady, New York.

Secretary—J. M. Hadley, secretary, National Standardization Division, American Mining Congress, Washington, D. C.

Scope—Rules for the safe installation and use of electrical equipment in metal mines.

The favorable reception by the mining industry of Safety Rules for Installing and Using Electrical Equipment in Coal Mines (M2-1926) led to the undertaking of a similar project for metal mines in 1930. A draft report, previously prepared by the American Mining Congress, served as the basis of the work of the committee; from this a second draft was developed. A meeting of the sectional committee, held in Washington, D. C., in December, 1930, brought out suggestions for further changes. The circulation of draft No. 3 in February, 1931, resulted in further criticism, largely concerned with requirements for grounded, return conductors for electrical circuits in mine shafts. These comments are now being considered by the sectional committee.

M25—Trolley, Storage Battery, and Combination Type Locomotives for Coal Mines, Specifications for

A summary of the status of this project will appear in the ASA Bulletin for January, 1932, with the electrical projects.

A.S.T.M. Representative on Petroleum Products Committee

M. H. Steinmetz, General Electric Company, Schenectady, N. Y., has been appointed to succeed F. A. Hull as representative of the American Society for Testing Materials on the Sectional Committee on Petroleum Products and Lubricants (Z11).

Zinc Coating Committee Studies Steel Embrittlement

The American Society for Testing Materials has recently issued the report for 1930–31 of its Committee on Corrosion of Iron and Steel (A-5). Included with the report are summaries of the recent activities of various subcommittees which are of particular interest to the metal industries. Data on field tests of galvanized sheets, hardware, structural shapes, conduits, etc., are given and a progress report on the embrittlement investigation is presented.

The question of steel embrittlement, the report states, has provided more discussions than any other single point in the development of specifications for galvanized structural steel. When Technical Committee III of the Sectional Committee on Specifications for Zinc Coating of Iron and Steel was preparing standard specifications for Zinc (Hot Galvanized) Coatings on Structural Steel Shapes, Plates, Bars and Their Products (ASA G8c-1930 and A.S.T.M. A123–30) this problem was only casually discussed. However, Technical Committee III proposed to the A.S.T.M. that it should undertake an investigation of the phenomenon of embrittlement of galvanized rolled structural steel. With this request for a research study, other organizations cooperated. Consideration of the proposed project led to its assignment by the A.S.T.M. Committee A-5 on Corrosion of Iron and Steel. In March, 1930, after careful study, it was decided to organize a subcommittee to plan and direct the research program.

The subcommittee, composed jointly of steel producers, fabricators, galvanizers, and consumers, and known as Subcommittee X on Embrittlement Investigation of Committee A-5, held its first meeting in Atlantic City on June 24, 1930. Later, after a study of the facilities of various laboratories to conduct the proposed investigation, the Battelle Memorial Institute at Columbus, Ohio, was retained to undertake research looking toward an explanation and solution of the problem. A small steering committee was formed to supervise the work.

The report of the committee contains the following statement concerning the investigations being conducted through the Battelle Memorial Institute:

"At about the time this matter was under consideration by the committee, the Utilities Research Commission engaged the Battelle Memorial Institute on the same problem, and six months' active work had been in progress when the committee's work was begun. The cooperation of the Utilities Research Commission has been secured, and the information developed by both investigations is available to each. The work has been so arranged that no duplication will occur, the work of each augmenting that of the other. The investigation is to determine the following:

"1. The causes of embrittlement encountered in hot-dipped galvanized structural steel;

"2. Depending upon the results of the research, to secure data as a basis for specifications for material or treatment suitable for hot-dip galvanizing;

"3. To formulate practical shop tests for detecting embrittlement.

"As brittle material is of rather infrequent occurrence, no samples of this material have been retained and are, therefore, not available for study. Accordingly, the work at Battelle Memorial Institute has been to review the literature, and then to study methods of test which could be used in specifications to prevent the inclusion of such a product in a commercial delivery. Further, through the cooperation of the rolling mills a field crew from the laboratory has been working in the mills, following the product through its successive steps, and testing the heats with the view to obtaining steel which exhibits the unsatisfactory characteristics. Since the start of the investigation no such material has been commercially encountered. Nevertheless, samples of these mill runs have been taken upon which laboratory studies are being made. These studies indicate conditions which might bring about embrittlement. So far, the ground work and certain fundamental indications have been established, but as yet no definite conclusions can be drawn as to the causes or their remedy. Decided progress has been made in the refinement of testing methods and in the development of new tests which bid fair to eliminate the personal question which makes the present test, on which rejection for brittleness may be based, less satisfactory than it should be. The various factors that tend to throw the properties of the final product toward the tough or toward the brittle side are becoming more clear, and several different possible causes for brittleness have suggested themselves, each of which is being studied in detail.

"This work is being financed by contributions from various sources which, up to the present time, amount to about $12,000. While these funds are sufficient to carry on the first year's work as contemplated, additional funds will be necessary to complete the project."

This subject, in the past one of controversy due to lack of knowledge of the causes of the trouble, has now been transferred from the forum to the research laboratory. Facts—not

opinions—are now being sought. The hearty cooperation of all interests affected by this investigation is a favorable augury. From this research, data that may markedly affect the present standard specifications for steel used for galvanizing and also those for zinc coated materials may result. Eventually, more serviceable galvanized products may be manufactured.

Reprint copies of the 67-page report of A.S.T.M. Committee A-5 can be obtained through the ASA office or directly from the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, for 50 cents each.

California Establishes Standards for Gasoline

As the result of the recent enactment by California of a gasoline and oil-substitution law, gasoline is now for the first time clearly and legally defined. Fuel for motor vehicles must now be specifically labeled "Gasoline," provided it complies with the specifications; otherwise, it must be designated "Not Gasoline." This statute has been enacted solely in the interest of and for the protection of the motorist. Other states are considering similar legislation to benefit the driving public in their own communities.

In the provisions of the new California statute gasoline is legally defined as any liquid petroleum product which conforms to the following conditions:

(*a*). It shall be free from water and suspended matter.

(*b*). A clean copper strip shall not show more than very slight discoloration when submerged in gasoline for three hours at 122 F, the test being conducted according to Standard D130–30 of the American Society for Testing Materials.

(*c*). It shall distill, within the following limits, when tested according to Standard D86–30 of the American Society for Testing Materials, using low-distillation thermometer:

1. When 10 per cent has been recovered in receiver, the thermometer shall not read over 176 F nor less than 122 F; provided that, if the total distillation loss is less than four per cent, then for each per cent of difference between four per cent and the total distillation loss, the minimum temperature requirement of 122 degrees, at which 10 per cent is recovered, shall be lowered $5^{4}/_{10}$ degrees.
2. When 50 per cent has been recovered in receiver, thermometer shall not read over 284 F.
3. When 90 per cent has been recovered in receiver, thermometer shall not read over 392 F.
4. End point shall not be higher than 437 F.
5. At least 95 per cent shall be recovered as distillate in receiver from the distillation.

The two A.S.T.M. Standard Methods of Test referred to above have been approved as American Standards with the ASA designations as follows:

Method of Test for Distillation of Gasoline, Naphtha, Kerosene, and Similar Petroleum Products—Zj11-1930 (A.S.T.M. D130–30)

Method of Test for Detection of Free Sulphur and Corrosive Sulphur Compounds in Gasoline—Z11u-1930 (A.S.T.M. D86–30)

It may be of interest to note that the provisions in the new California statute for determining corrosion and rate of distillation are similar to those given in the revised specification for U. S. Government motor fuel, which was promulgated by the Federal Specifications Board on July 21, 1931, to become mandatory on October 21, 1931, for all gasoline purchased by the Federal Government. Certain additional provisions in the government specification cover the upper limits for sulphur, the vapor pressure that gasoline shall have in different seasons of the year, and also the requirement that with certain temperature conditions in the winter months the first ten per cent distilled shall be evolved at 149 degrees Fahrenheit.

Government Publications Relating to Textiles

There has recently been issued by the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce the third edition of the pamphlet entitled *Government Publications Relating to Textiles*. This pamphlet lists all reported publications issued by government bureaus dealing with the textile industry. In the present issue there are included the names of 23 government bureaus which have issued publications relating to textile subjects together with a listing of these publications conveniently classified under various subject headings.

Copies of this pamphlet may be obtained at the district and cooperative offices of the Bureau of Foreign and Domestic Commerce, or from the ASA office.

Engineering and Shop Standardization as a Means of Reducing Overhead[1]

by

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Advantages resulting from different types of company standardization; suggestions for the organization of standardization work

Standardization is a scientific determination of the one best way to do a thing, the reduction of that one best way to the printed word, and the adoption of that way as a procedure.

Standardization is to be used in all places where the ultimate result is savings. The standards must be furnished engineers and all other executives in some readily accessible form, with positive instructions that these standards are to be followed unless there is specific permission from the chief engineer or the works manager or the general manager, whoever is put in charge, to vary from that standard.

Because of his peculiar psychology, the traditional method of treating a designer is that he is a genius who has to be coddled, and whose final design, final word, is law. How often we hear the familiar statement: "It has to be made the way I design it; that's the only way it will work . . ." or "This particular steel is absolutely necessary; we cannot use a cheaper steel—we have to use this particular material."

The average engineer's knowledge of economics is very limited. Some managements have had the courage to question the prerogatives of these draftsmen and designers, and they have found after such questioning that the democracy of ideas is much more profitable than autocracy. One of the results of such a questioning of the divine right of the engineer is that of standardization.

In considering the matter of when standardization pays, suppose we are making a variety of similar machines, or even stoves, tractors—almost anything. Suppose we have five machines, all of which are similar in design but vary in size or in some other way. In each of these five machines we have a part which performs a similar function. Each of these functions is different due to the difference in size of machines. Suppose we standardize this one part. The functions are similar and we can standardize. We arrive at a standardization which possibly is more complicated than any one of the individual parts, and it looks as though it might cost a little more. We turn it over to our cost accountants and find, after the usual costing method, which is to take the number of shop hours and the shop overhead in each department, plus the material, that the new part costs about the same or even a little more than the old part. If we are not going to save anything—why standardize? But by looking into the matter a little further, for the five parts we have five departments; five drawings; five part number routines; five sets of blueprints, patterns or dies, and materials; five purchase orders, five purchase order follow-ups and routines, five invoices and incoming information; five bookkeeping entries, check payments, and the accompanying routine; five items to receive, count, and handle separately, and store; five sets of stock bin space (one might say it takes just as much space to store 50 parts at one time as it does five different parts of ten each. But that is not the case. It will take at least double); five sets of inventory counts, pricings, and extensions; five sets of job order tickets, tracer tickets, and follow-ups; five sets of time sheets, performance and labor records; five machine set-ups against one; five teardowns; five sets of jigs and special tools; five sets of inspection gages; five sets of stores handling records; five sets of cost accounting records; and other details too numerous to mention.

Considering that the overhead rate is somewhere around two to one of the labor rate, it

[1] Presented at the Production Conference of the American Management Association held in Rochester, N. Y., June 1, 1931. Reprinted by permission of the American Management Association from Production Series Pro. 100, *Engineering and Shop Standardization*, by Thomas R. Jones.

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will be apparent that the saving through standardization lies not so much in direct labor as it does in reduced overhead. It is also very probable that a good deal of the cost of overhead in the shop originates in the design department. So the usual method of cost accounting will not apply and may very easily be misleading.

Results of Standardization

As to the purposes of standardization, it is not limited to the number of items out of the overhead I have just enumerated. There are a great many intangible by-products, and some tangible. To summarize the whole thing, standardization will lower direct production costs through the elimination of a large variety of parts going through the shop. The workmen will become more familiar with the parts as they go through and can make them in larger quantities, and the result will be lower direct costs.

There is also lowering of direct costs through the simplification of shop operations, standardization of shop methods on the most economical way of doing a thing. A standardization program includes not only the standardization of design but the standardization of shop practice out through the shipping room door.

Standardization will lower the indirect cost and through the elimination of functions, as I have previously brought out, reduce the inventories. If a fewer number of parts can be manufactured and manufactured for stock, a good deal of the dollar value of the inventory will be eliminated. It will, of course, decrease the financial investment, decrease the storage space for that inventory, and leave some of the storage space for manufacture.

It will increase the flexibility of manufacture. In standardizing largely between the machines the variety of machines can be the same as it always has been, but there will be a smaller variety of parts which can be produced through inventory instead of in odd job lots. It takes the guesswork and designing away from the shop. Very often at least 25 per cent of the designing is being done out in the shop. It is not at all uncommon in the average shop for each foreman to have his own standard, and sometimes the individual workmen. By eliminating the necessity of the designer spending his time on individual parts, the designer's attention can be directed to the bigger things that he has to do, to his inventions, etc. It is desirable to make the design fit the equipment economically, as in designing for disc grinders; Blanchard grinders; centerless, automatic lathes; formed tools; simplified patterns; core boxes; and castings. I remember a particular design of shafting. All shafting under one inch was standardized in five-eighth and seven-eighth inch sizes. Any collars or uneven spots in the shafting were eliminated so that it was all put through the centerless grinder at a tremendous saving.

To be properly standardized on the methods of producing castings, a large amount can be eliminated between the foundry and the machine shop. Through a proper means of standardization large savings can be brought about in the foundry.

Another object to be achieved is the appearance of the company product. I have in mind one company that made five different tractors. You could not tell by looking at one that it had any relation to the other; each was made by a different designer; there was no uniformity in the group.

Last, and by no means least, is the possibility of reduction of error in the shop drawing room. That is, the supervisor becomes familiar with the standards and a reduction of error results.

Standardization may take several forms. It may be:

(*a*). Design method alone. It is surprising how many different formulas the draftsmen can use in the designing of different shapes, for example, and the results may be 100 per cent different in their stress-resisting ability.

(*b*). Standardization of material. In our own standards department we found that for a certain cam in various machines, we had seven different materials; one material would do the work.

(*c*). Standardization of rough stock. If there is a variety of gear sizes it is possible to standardize the gears. Drop-forge them and make a saving of the rough stock.

(*d*). Assembly units can be standardized so that a gear box on one machine can be put into two or three other machines.

(*e*). The form of complete machines can be standardized. For instance, in any shop Monarch lathes are immediately recognizable because their complete machines are standardized.

(*f*). Standardization of shop methods. For example, in the manufacture of pottery, standardization will probably apply largely to shop methods. All of the above methods apply in an industry which is manufacturing machines.

I have been asked by a good many people where to start a standardization program. It is a case of all roads leading to the engineering department. I have yet to see a drafting room

which is operating on the old method, without uniform practices, that is, sending to the shop blueprints that have uniform designation of parts, uniform phrasing of dimensions on those parts, uniform methods of specifying finishes. The variety of fits between shafts and bearings in a drafting room of that kind is remarkable. Very often the man in the shop has to make his own fits and use his own ideas as to how the things should be made.

Some draftsmen will use tolerances; some will use limits; no two use the same formula for the designing of the same parts. I have in mind the standardization of gears undertaken under my direction. No two of the draftsmen had the same formula for designing gears. Most of them used a certain formula for designing the strength of the gear tooth and I doubt that one of them knew that it was advisable, if not necessary, to design a gear for wear.

The sad thing in gear designing is the prevalence of the cut-and-try method; they know a certain sized gear will operate with a certain hp, and if they want to increase the hp of the motor, they increase the gear sizes, and experiment in their gear-manufacturing departments, and in their transmission departments.

After the drafting-room practice has been established, it then comes to the point of standardizing on parts. This is by no means a simple thing, and is by no means a thing we approach lightly.

Standardizing Cap Screws

Let us take a simple thing like a cap screw. First standardize the diameters, and then the length, and then choose the smallest number consistent with the purposes served by cap screws. In order to decide on the lengths, the flanges to be put in the cap screws have to be standardized. Then there is the decision between hex heads or square heads, half heads or full heads, slotted, Fillister, or whatnot. Then comes the trade standardization. By the way, there is a marvelous piece of thread standardization which was undertaken by the National Screw Thread Commission, copies of which are available at the Bureau of Standards.

The question of what fits are necessary between that cap screw and the hole it goes in brings up the necessity of standardizing the hole into which that cap screw fits, and in turn, the allowance, limits, and depths of hole, the size of the plug tap, and of the bottoming tap that makes the hole. What is the result? Standardized cap screws, standardized holes, standardized drills that make the holes, taps, wrenches, and incidentally the drawing-room and shop practices, and that includes wrench clearance; when to use lock washers, when to use plain washers, countersinks, flanges, nuts, bosses, dowel pins, and so on and so forth. But, one may say, this is a tremendous amount of trouble to standardize such a simple thing as a cap screw. It is, but there is a tremendous saving involved, because if they are not standardized the draftsmen have to design them every time they make a drawing. If the draftsman does not design it, the fellow out in the shop has to, and the waste time and leg motion eliminated by setting standards and holding to them are certainly worth the trouble taken.

The funny part about this leg motion is that the shop thinks it is part of its job, never questions it. They have done it all their lives and have never questioned the fact that they have to keep running to the drafting room to find out about this cap screw, and so on and so forth.

Let us take a more complicated thing—standardization of steels. I have yet to find a draftsman who does not have his pet steels. Those steels may have a trade name. A trade name, in my humble opinion, is a camouflage. It is one way to get by the S.A.E. standards. Those draftsmen will swear that for the part to function properly and resist the stress to which it is subjected, it must have a certain steel. We found a certain standardization program absolutely blocked by 25 or 30 designers, each with his own ideas of steel, and they refused to consider anything else than their own individual ideas. We settled it by taking some parts he had designed to each man, saying: "Now you have used a certain steel here. What stress did you expect to get from that steel? What did you expect it to do under this circumstance?" And we got him nailed down to what he expected of that steel. Then we went into the shop, got some of the parts, put them through the test to see if they lived up to the specifications, and we found that, owing to the large variety of steels we had, the men in the heat-treating rooms were unable to apply any standardization to the method of their heat treatments and, consequently, were unable to give adequate heat treatments to the parts as they came in, and the results we were getting from some of these expensive alloy steels the draftsmen were specifying were not equal to the results we got with ordinary chrome nickel steels with uniform and controlled heat treating.

We also found that in order to get adequate heat treating we had to use electrically controlled furnaces, and preferably electrical furnaces. A program of that kind, in one company I was in, took three men and they spent six months standardizing materials. They would take any kind of steel offered to them

by the various companies, and start it through from the beginning. They would put it through lathes—automatic lathes—drill holes in it, cut gear teeth in it, grind it, and keep a record of what each steel did under each process; heat treat it, take test bars from the steel, and submit them to test for strength. Of course I do not mean they brought every one of these steels all the way through, because some of the steels automatically eliminated themselves in the first process.

We started with 160 varieties of steels; we wound up with three major varieties, and two used in certain specific cases, making a total of five. We are up against the same problem now in my present connection, and are bringing our sizes down to about a similar proportion.

After we have all that done, then we are ready to standardize on our sizes. If we are able to use hot rolled steels, that is not so much of a job. If we use ground steels or cold rolled steels, we have quite a problem. In the first place we have to decide whether we are going to use standard holes or standard shafts. That means automatically that we are going to standardize on our drills. Whether we use a standard hole or standard shaft is going to determine the life of our reamers. We also have to determine what we are going to use for press, drive, tap, running, sliding, and free fits.

I might say I have seen drawings which will specify press fit and their range of allowance from the shop for press fits will certainly astonish you.

It is necessary then to determine what safe loads are, what kind of an oil groove to put into the bushings, and how to get the oil into the bushing. As soon as bearing lengths are determined it is necessary to decide on the thickness of the wall in the hub, and there are the hubs for all your gears, hand wheels, etc.

I have rambled on at great length on standardization for two reasons:

1. To point out that the thing is involved and money will have to be spent to complete a thorough standardization program;

2. To show that standardization must be basic. It must result only after thorough, detailed, and scientific investigation.

As to the standardization organization procedure under which one operates, in the first place, there will be opposition to any standardization program. The first place one meets it is in the place which should be sympathetic—the engineering department.

I have had managers tell me that standardization limited progress. That is the last thing a standard must do. Standards must be living and breathing things. They must go along with the business and the first man to question a standard must be the man in charge of the standards department.

A Standardization Committee

A standardization program requires a great deal of education. Probably one of the best ways to carry on that education is to organize a standardization committee. This committee should include the superintendent of the shop, all the principal engineers and designers, the head of the time study department, the head of the tool department, planning department, the works manager, and any other important functionaries. Each man should be responsible for seeing that a standard is acceptable to his department. There are no meetings of this standardization committee. That is a good way to get nowhere. It is better to make a blueprint of each standard, send it to the members of the standards committee, and have them put their comments or objections, or approval on the back of that blueprint and sign it. Those signed blueprints sometimes come in awfully handy later.

So far as I know, no member of a standardization committee has had a standard forced upon him; that is, a standardization committee that has been under me. Whenever a man objects, we have tried to prove our point to him. We have tried to show him where the standards were right; or he proved to us where the standards were wrong. Sometimes a standard would be delayed as much as three months by the fact of some holdout, but one or the other proved to be right, and the standard went ahead or was abandoned; usually going ahead.

As to the organization, that is a very peculiar thing. In starting my first standardization programs I tried to take some of the best men from the existing engineering organizations. On my first attempt I learned that was wrong. Those men had been so steeped in the design of what they were doing that they knew all about how not to do things or how things could not be done. Consequently, when it seemed desirable to standardize a certain thing, the objection from the designer was that it could not be standardized.

Some method of keeping these standards is essential. I have always used a standards book. They have to be thoroughly cross-indexed, readily referenced. An interesting thing about these standards books is that they have to be watched very closely. If not, a designer leaving will take one along for a textbook. There is a lot of design in the standards book that he never got at college.

Another precaution which must be taken is that of passing all designs through the standards department. Every engineer, no matter how hard he studies his standards book (and he probably won't study it very hard at the first), will make mistakes on his standardization. It is necessary that that drawing be passed through the standardization department. This may not be at any extra expense because your standards men can be your checkers. The way we are working it out now is in that direction.

Now, what may be expected of standards? More time released for designs; costs reduced; a closer check on the shop; and a lot of money saved.

We brought out two presses, one press single-color, another two-color, with one pass through the machine. Those presses are very different in size, and quite a bit different in design, for the reason that you have two colors on one, the single color on the other. Yet on the two-color, 71 per cent of the parts go on the single color; and on the single color, 76 per cent of the parts go on the two-color. Imagine the amount of saving in tools, tooling, and processing in just that one thing.

Standardization is a scientific determination of the one best way. It is based on relentless research. There must be no regard for present practice. Standardize first on the ideal. After the ideal is determined, if it can be adapted to take in present practice, that is just so much more saving.

When can a change be made? Whenever it is economical to do so.

When can one vary from the standard once a standard is set? Whenever it saves money to vary from that standard. That won't be very often, but there are such cases.

Last, but not least, does standardization pay? I can only answer that categorically. I am in my third standardization program now, and in every one standardization has paid faster than we could save money spent for setting standards.

Discussion

John Gaillard:[3] The American Standards Association is a clearing house for national standardization work. As a central body, we have a good view of the conditions under which standardization work is going on in this country. The Association was founded in 1918 under the name of American Engineering Standards Committee by the four principal engineering societies—the mechanical, electrical, mining, and civil engineers, plus the American Society for Testing Materials—to act as a clearing house for standardization, so as to avoid duplication in this field—for example, by one standard being set up by the American Society of Mechanical Engineers, and another one on the same subject by the Society of Automotive Engineers—and also to promote standardization work.

[3] Mechanical Engineer, American Standards Association.

In the meantime, we have reorganized and become the American Standards Association, at the present time a federation of 45 trade associations, technical societies, and seven Federal Departments, such as the Department of Commerce, War Department, Navy Department, etc. American Standards are being set up by technical committees organized under ASA procedure; moreover, we are particularly interested in standardization work undertaken by individual companies. In the course of years we have tried to keep in close touch with company standardization.

It might seem difficult to distinguish exactly where standardization is going to affect direct costs, and where indirect costs. However, the great advantage of the standardization movement in this respect is rather that it leads to the necessity of analyzing the job as a whole. Many costs which originally appeared to be direct and unavoidable costs may appear to be, after the analysis has been made, indirect costs and perhaps avoidable.

Standardization has so far been a kind of step-child industry, despite the fact that American industry has become famous for the amount of standardization put into it. I keep in close touch with standardization bodies in foreign countries, and I have found people abroad saying to me: "In America you are so much more standardized than we are." A few years ago I was scheduled to read a paper on standardization before the Taylor Society. Instead of mentioning on that occasion what we had been doing, or what we were aiming at, I decided to make a study of why there is not more standardization; that is, standardization as a managerial technique, not something that pops up here and there, when a thing is made a certain way and then called a standard. I was satisfied there was too little of the right kind of standardization in the country. This opinion was based on the following facts. ASA had been in existence for eleven years at that time, and we had carefully recorded every company or organization known to have a standards department. We found that we had only 70 or 80 names of manufacturing concerns, mostly in the metals-working industries, which had standards departments of their own.

To have a basis of measurement, I looked up the latest report of the Bureau of Census at that time and found that in 1925 there were about 10,500 manufacturing concerns making

more than $1,000,000 worth of products per year. I took that basis for comparison because I thought that a firm making a million dollars worth of goods per year might well be expected to give due consideration to the standardization movement, were it only by assigning one man to this task, as the beginning of a standards department.

We had collected 70 or 80 names during ten or eleven years, and if we rounded this up to 100, and assumed that we knew only half the truth, we found that only 200 companies out of the 10,500 of the larger ones—mind you, none made less than a million dollars worth of goods per year—had their own standards departments. That was a pretty poor showing; I came to the conclusion that our fame for industrial standardization was based rather on the achievements of a relatively few big concerns doing an extensive job of standardization than on the general acceptance of standardization by industry at large as a managerial technique.

One of the questions which the treasurer or the comptroller of the company especially will always ask is, "How much does standardization save?" Professor Brady, a young professor of economics, a few years ago collected material for the very elaborate report on industrial standardization which was published under this title by the National Industrial Conference Board. He worked in very close contact with our office; one of the things he wanted to determine was what savings resulted from standardization.

I was rather skeptical in this respect before he began his study because most people will not be able to tell what they save by standardization, because they do not have a cost accounting system which shows it. That is what Brady found. Even if standardization was applied, usually it could not be shown exactly where the savings began.

Fortunately, however, ASA has been able to collect some fine examples of savings which I may mention here, as well as examples of peculiar situations existing through lack of standardization.

In a large railroad center, there are four railroads of primary importance, each of which uses steel tubing in 25 or 30 different sizes. There is one manufacturer in that center who supplies all four companies; to do so he must keep in stock more than 100 sizes of tubing. In the end, of course, the railroad companies have to pay for this situation.

I do not mean to say that in general the railroad companies have not an open eye for standardization. On the countrary. For example, a technical committee of the American Standards Association has worked out a standard for track bolts, and the railroads, of course, took a major part in this work.

Fairbanks Morse Company use cap screws with a diameter of one inch and a length of four inches. They had to pay $50 to $70 per hundred pieces before standardization went into effect and paid $9 after the screws had become standardized under ASA procedure. It simply did not pay the average manufacturer of bolts and nuts to make a special set-up for a lot of only 100 cap screws.

Standardization so far has made very little progress in the textile field. However, a company making looms gave us a list of 15 different items to which they had applied standardization and cut down the diversity. The reduction in variety was 40 per cent on the average. I shall mention only one item. They cut down the hexagon and square nuts from 173 to 76, the reduction being 56 per cent; this single item gave a saving equaling 40 per cent of the total appropriation for the standardization division. In seven months, the savings shown by that division had grown to three times the annual cost of the work. I should say that is a pretty good investment.

A large machine tool manufacturer saved $10,000 a year by eliminating the odd varieties of bolts and nuts. Another interesting case is quoted in a book by James H. Rand, Jr., entitled *Assuring Business Profits*.[4] A firm made the same kind of filing cabinets with and without locks. With a lock they cost $2.70 more. After making an analysis of production, storeskeeping, etc., it was found to be more economical to make all of the cabinets with a lock for the price charged for cabinets without a lock. That is, the savings through standardization exceeded $2.70 per cabinet.

We have found that the work of the American Standards Association is not so widely known as it should be. We are trying to get everybody around the table in cases where standards should be set up. Requests usually come from a technical society or trade association; it is impossible in principle to act on the request of an individual firm. Often, of course, a private firm writes that they would like to see a certain object standardized. We usually ask them to have their trade association make the request. If there is no trade association in the field, a group of manufacturers representative of the industry may act.

The National Screw Thread Committee, appointed in 1918, brought out its first report in 1921. In 1920, a technical committee had been organized under the auspices of the American Standards Association, and the two bodies now got together; the result was an American Standard on screw threads as published in 1924.

[4] B. C. Forbes, N. Y., 1926.

One of the things Mr. Jones pointed out worries a lot of people—the fear of stultification of progress by standardization. In that respect I may say that, independent of the procedure by which a standard is set up under the auspices of the American Standards Association, it can be changed just as fast as progress demands. If we visualize technical progress as a curve, and if in manufacturing we had to follow that curve closely, there would be no stability, but continuous change. What standardization does is to replace that curve by a series of horizontal straight lines, each level being a standard valid for a certain period of time. The curve will continue to go up and when the difference between the level of the standard and the progress curve has reached a certain value—we might visualize this as a "tension"—the standard will jump up to the next higher level, and stay there until further progress justifies a change in standard. Such a jump may occur in two or in ten years—sometimes nobody can tell—but, in the meantime, everybody knows what he is supposed to make or may expect to receive.

With respect to the fear of designers, managers, and others, that too much standardization will automatize the business to the extent of making them superfluous, I would quote a definition of industrial standardization given by A. W. Whitney, former president of the American Standards Association:

> "Standardization is the liberator that relegates the problems that have been already solved to their proper place—namely, to the field of routine—and leaves the creative faculties free for the problems that are still unsolved. Standardization from this point of view is thus an indispensable ally of the creative genius."

JAMES E. GLEASON:[5] Standardization is a subject in which every manufacturer is deeply interested. It has always seemed to me that the standardization benefits, so far as production is concerned, are perfectly obvious. One other benefit is the pegging of the advances standardization has made possible, and the boiling down of the experience of the ages. The right standard, the one best known way of doing a certain function, will not, of course, bring us to perfection, but we should come somewhere near it. That seems to me the great benefit of standardization—just settling on the thought that we want the best there is, and spending the time on each detail to a far greater extent than we should if we were just designing a machine haphazardly.

A great research engineer recently expressed the thought that we were over-standardized, that we had gone standards mad, you might say, especially in this country. He said:

> "You take the railroads; they put certain car couplers on their cars, and they are there forever after; they can never make a change; the railroads would be better off and have better equipment if they had less standardization."

We can all imagine where we should be without the standardization of those particular car couplers.

[5] Gleason Works.

New Federal Specifications Are Available

The following Federal Specifications have recently been printed and copies are available through the ASA office or from the Superintendent of Documents, Government Printing Office, Washington, D. C.: condensed milk; paper negative preservers (photographic); hominy-grits; canned hominy (lye); tapioca; hemp twine; large tungsten filament incandescent electric lamps; miniature tungsten filament incandescent electric lamps; amalgam dental alloy; apple butter; peanut butter; biscuit; soda crackers; bread and rolls; candy; effervescent table water; wood screws; laundry appliances; canned crab meat; canned oysters; canned tuna fish; coarse aggregate for Portland cement-concrete pavement or base; olive-drab ready mixed and semipaste paints; volatile mineral spirits paint thinner; dry and paste-in-oil basic sulphate white lead; unshrunk indigo blue denim; shrunk brown denim; compressed gauze bandages; plain velvet carpets and rugs; Wilton carpets and rugs; canned lima beans; turpentine; wool bunting.

All of the above specifications are five cents per copy except that for laundry appliances which is ten cents.

A.S.T.M. Supplement to 1930 Book of Standards

The American Society for Testing Materials has just issued the *1931 Supplement to the Book of A.S.T.M. Standards*. The *Book of Standards* was published in 1930.

This *Supplement* contains 32 standards adopted or revised by the Society on September 1, 1931. Seven of these standards relate to metal and 25 deal with non-metallic materials.

Copies of the *Supplement* will be furnished free of charge with orders for the *A.S.T.M. Book of Standards* or may be purchased separately for $1.50 per copy.

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